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A SKETCH OF THE GEOLOGY OF SOUTH AMERICA.

BY GUSTAV STEINMANN.¹

IN preparing a sketch of the geology of South America I feel obliged to add some explanatory remarks. This sketch accompanies a map which forms a part of the second edition of the Physical Atlas of Berghaus (Gotha, Justus Perthes), which publication will be finished at the end of this year. Besides many other maps, the geological part of this atlas has sketch-maps of all continents, which represent the actual state of our knowledge. In preparing the sheet of South America I was aided by many geologists who, like myself, had occasion to explore some parts of this continent, especially by Orville Derby for the part of Brazil, by Luis Brackebusch for the part of the Argentine Republic, and by many others.

I thought it of some interest to the Association of North American Geologists to explain the main resemblances and differences which exist between the northern and the southern part of the great American continent, and to urge some remarkable points in the geological evolution of South America.

I pass by the primordial rocks, very imperfectly studied as yet in South America. The Paleozoic rocks are better known, and offer great interest. By the investigations of d'Orbigny, Forbes, Kayser, Rathbun, Clarke, Orville Derby, and those made recently by Dr. Ulrich, of Strassburg, upon the rich collection of

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fossils I brought home from the central plateau of Bolivia, the two following interesting points have been demonstrated :

1. That nearly all parts of the Paleozoic formations are represented in South America by marine deposits, being known by Cambrian, Lower and Upper Silurian, Devonian and Carboniferous fossils. As far as our knowledge extends, the older Paleozoic deposits—*i. e.*, the Cambrian and Silurian formations—are generally more disturbed and metamorphosed than the Devonian and Carboniferous series. In consequence of this fact, the faunas of the latter formations are better known than those of the former.

2. The richest Paleozoic fauna as yet known from South America is that of the Devonian formation. More than 150 different species have been described. The rich and well-preserved fauna collected by me in the eastern part of the Bolivian plateau has enabled Mr. Ulrich to show that the Bolivian deposits form a very important link between those of North America on one side, and those of Brazil, the Falkland Islands, and South Africa on the other side. The highly fossiliferous clay slates, sandy clays, and sandstones widely distributed in Bolivia and Brazil are the equivalents of the Oriskany sandstone, the Upper Helderberg, and the Hamilton groups of North America. Their fauna bears an American, not a European, character, as proved by the two commonest and most characteristic Brachiopods :

1. *Leptocælia flabellites*. This fossil has been found in North America, Bolivia, on the Falkland Islands, and in South Africa.

2. *Vitalina pustulosa* is known from North America, Brazil, Bolivia, and South Africa.

Partly by the identity, partly by the similarity of the Devonian faunas of the named regions, it appears quite evident that a great Devonian sea embraced large parts of both Americas and South Africa.

The Carboniferous deposits seem to be much more restricted in South America than the Devonian. The sub-Carboniferous is mostly composed of non-fossiliferous sandstones; the Upper Carboniferous, containing representatives of universally distributed Brachiopods and Gastropods, and of the genus *Fusulina*, is known from Peru, Bolivia, and some parts of Brazil.

During the Permian, Triassic, and Jurassic epochs the greatest part of the South American continent, in the same manner as the North American, was above the sea-level, for according to the researches made by Brackebusch in the Argentine Republic, by myself in Bolivia, and by Derby in the Matto-Grosso region, a great if not the greatest, part of the red sandstones generally considered to be of Permian or Triassic age seems to belong to the Cretaceous formations,—probably to the lower part of it. The flora which existed during the Permian and Triassic periods upon the South American continent is of high interest. The coal-bearing deposits of South Brazil and those of the Argentine and Chilian Cordilleras contain many representatives of the so-called “Glossopteris flora” known from South India, Australia, and South Africa. The age of these coal deposits is not everywhere the same. The flora of South Brazil has been referred to the younger Paleozoic, because it contains some Paleozoic types of plants; those of the Argentine and Chilian Cordilleras belong to the Rhaetic group, and are partly covered conformably by marine deposits of the Lower Lias.

Marine deposits of the Triassic and Jurassic formations have only been found in the western part of the continent,—namely, in the Cordillera between the 5° and 35° of southern latitude. The Triassic fossils are of the same type as those found in California and Western Canada, the leading fossil being a species of *Pseudomonotis* of the group of *Ps. semicircularis* Gatt.* From the Jurassic formation nearly all horizons have been found in a fossiliferous state, and the rich collections made in different parts of the Argentine, Chilian, and Peruvian Cordilleras have enabled us to determine that the succession of marine organic life during this period was quite the same on the Pacific slope as in Europe and East India, and there have existed very intimate faunistic relations between these regions. As regards the extension of marine deposits of the Triassic and Jurassic epochs, there exists a remarkable similiarity between North and South America, being themselves confined to a small strip parallel to the Pacific coast.

In contrast to this small extension of marine Triassic and Jurassic rocks, the Cretaceous deposits cover a very large area in South America. Marine Cretaceous fossils are found in nearly all parts of the Cordillera from South Patagonia to East Venezuela, and Mr. White has discovered a rich fauna of the Cretaceous formation of East Brazil. The invasion of continental areas by the sea at the earlier Cretaceous period, which has been observed in many parts of Central Europe, seems to have taken place on a much larger scale in both Americas. We know now, by the investigations of Hill and White, that a part of the Cretaceous strata of Texas formerly regarded as Upper Cretaceous belongs to the lower part of this formation. The Cretaceous formation of Mexico appears as a direct continuation of the Texas deposits; and as far as our present knowledge extends, the relations between the faunas of the older Cretaceous of these regions and those of Venezuela, Colombia, and North Peru are very intimate. It is interesting to see certain characteristic fossils of the Lower Cretaceous of the north reappear in the south. The famous genus *Aucella*, widely distributed on the slopes of the North Pacific, has been recently mentioned by N. Ritin from Mexico; by White from Brazil; I know it also from the environs of Lima associated with *Ammonites* of the Neocomian of Europe. The Cretaceous sea which covered the central part of America probably continued farther to the east. We find, therefore, some remarkable relations between the Lower and Upper Cretaceous faunas of South America, especially of Colombia and Peru, and those of North and West Africa. Some forms of *Buthiaceras* known from Algiers are found abundantly in the Upper Amazonian region. The truly marine deposits of the central part of America disappear to the north and the south, and seem to be replaced by sandy deposits without marine fossils: Probably a great part of the red sandstone formations which occur in Brazil, Venezuela, Bolivia, and in the north of the Argentine Republic, take the same place relative to the marine sediments of the older Cretaceous as do the *Atlantosaurus* beds, the Trinity and Tuscaloosa formations in the north,—namely, underlying themselves or forming an equivalent of them.

I cannot conclude my remarks upon the Mesozoic formations of South America without mentioning the two following peculiarities. The first is the fact that, wholly independent of the marine Cretaceous deposits of the Cordillera on the Pacific coast of South Chili, glauconitic sandstones are found which contain a rich fauna of the uppermost Cretaceous, especially on the Island of Ouiriquina. Besides many Ammonites and Baculites, partly identical with those from South India, this fauna is characterized by the abundance of Gastropods of a Tertiary type. The Cretaceous beds are covered conformably by a lignitic formation, whose fauna does not contain the Cretaceous fossils; but stratigraphically both formations are intimately united. So a curious parallelism seems to exist in these deposits of South Chili, with the Chico-Tejon group of North California.

The second point to be pointed out is the abundance of eruptive rocks within the Triassic, Jurassic, and Cretaceous formations of the Cordillera. On the western side of the border of Chili and Peru, where the marine deposits of these formations predominate, only a very small part of the rocks are formed by limestones, clay slates, or sandstones. These appear, however, to be interlaid between stratified masses of porphyritic, melaphyric, and andesitic material, the entire thickness of which strata reaches several 1000 meters. So far as we know, this is the largest area of eruptive formation of Mesozoic time. The Cordillera of South America is famous for its eruptive formations of the latest time, but it merits no smaller attention for its submarine eruptions during the Mesozoic time, and for the injection of the Mesozoic strata by truly granitic and dioritic rocks.

The Tertiary formations, well developed in the Argentine Republic, have been subdivided into a number of groups by Döring. According to the researches of Ameghino, the younger Tertiary deposits of South America show a remarkable peculiarity. This paleontologist discovered the remains of human beings not only in the Pliocene, but also in the Miocene, deposits. I must confess that, comparing the European Mesozoic strata with those of South America, quite another classification of the latter seems to be indicated. What has been called the Pampean formation in the Argen-

tine Republic, and referred to the Pliocene, is no other than the Loess in Europe, whose formation took place between the two latest glaciations. Adopting this view of the case, the so-called Miocene strata probably belong to the great ice period, and the Pehuelche stratum represents only the morainic deposits of the last ice period. The Plistocene deposits of South America are not yet studied in detail, but the glacial deposits I met in South Patagonia can be easily distinguished into two different groups: those of a former more extended and overarched formation, covering not only the lower parts, but also the table mountains of over 100 m. in height; and the younger formation, the kettle moraines of which are found along the foot of the Cordillera. The extension of true glacial deposits within the Cordillera seems to be much greater than generally admitted. Twenty years ago Raimondi described clearly true moraines from the Cordillera Nev. of Ancachs (about 9° s. lat.), reaching down to 2500 m. above the sea-level. I myself found moraine deposits in the Cordillera of Copiapo (28° s. lat.), about 1200 m. above the sea-level, and these observations coincide quite well with those made north of the equator by Sievers, who found the traces of former glaciation in the Sierra Nevada do Santa Marka and in the Sierra Nevada do Tarija. These facts seem to prove that the glacial periods did not alternate on both hemispheres, but that they were contemporaneous. In this respect further studies upon the Plistocene formations of the Cordillera of South America will be of great scientific value.

Besides the true glacial deposits and the æolean formation of Loess and loam, there exist in South America, especially on the High Plateau of Bolivia, like deposits of great extent. Terraces and tufa deposits analogous to those of the Great Basin of the West indicate a formerly much wider extension of the Lake Titicaca over the whole High Plateau from Southern Peru to the Argentine frontier. It seems that this former extension of lakes in South America coincides also with that of the lakes of the Great Basin region.

NOTES ON THE HEARTS OF CERTAIN MAMMALS.

BY IDA H. HYDE.

IN preparing a thesis for the degree of bachelor of science at Cornell University, in the spring of 1891, certain facts were observed and conclusions reached which have been thought worthy of presentation, if only as an evidence that further investigation is needed.

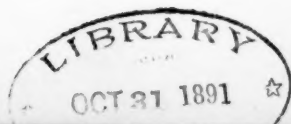
Professor Wilder placed at my disposal the following materials: Many hearts of the sheep and domestic cat, several human hearts, and the hearts of a monkey, panther, raccoon, hyena, dog, deer, calf, horse, donkey, and rabbit.

Special attention was given to the following parts: The Tuberculum Loweri, Eustachian valve, Thebesian valve, coronary sinus, and the oblique vein of Marshall, a few of the facts that seem of chief importance I shall state in the briefest possible manner.

The Tuberculum Loweri.—According to "Wilder and Gage's Anatomical Technology," "the distinct presence of the Tuberculum Loweri and the Eustachian valve have as yet not been determined in the cat." Nevertheless, I found what I consider the homologue of the Tuberculum Loweri of the human heart present in every heart examined. Although Hyrtl denies its presence in the human heart, all other authorities agree that it is a constant feature of it.

The Eustachian Valve.—Of the hearts examined, the Eustachian valve was found only in man, monkey, and a remnant of it in the cat, but not extending above (cephalad) the coronary sinus orifice as in man and monkey, but below it (caudad) and protects it. In the fœtus of the cat it is of relatively as great in extent as in man, but in the adult cat only a valve guarding the coronary sinus orifice remains. It is this valve that has been mistaken for the Thebesian valve by several anatomists.

The Thebesian Valve.—The statements concerning the Vieussens and Thebesian valves are perplexing. Allen and Gegenbaur say



"the Thebesian valve covers the opening of the coronary vein," whereas that valve over the orifice of the coronary vein is known as Vieussens valve, in honor of its discoverer. According to Heath, "the coronary valve guards the opening of the coronary sinus." But Thebesius was the first to make known the form and position of the valve over the termination of the sinus, and in his honor it is called the Thebesian valve.

According to Marshall, "the Thebesian valve is present in every instance in which the coronary sinus receives blood from the heart alone, as in man, monkey, dog, and cat, but absent in those animals that have a left azygos or left precava." Since the Thebesian valve was found only in man, monkey, and rabbit, and not in the cat, panther, and dog, where Marshall says it ought to exist, and one is present in the rabbit, where he says it ought not to be, this generalization will not hold good. A valve existed over the orifice of the middle cardiac vein in every heart examined, and as it is not named in any work as far as I know, I would suggest that it be called *coronary valve*.

The Coronary Sinus.—Morrell says "the coronary sinus of the sheep is the lower dilated part of the left azygos." Marshall holds that in those animals in which a left azygos or left precava exists it empties directly into the right auricle, and the coronary vein opens into it.

Bourgery, Owen, Gegenbaur, and Howell think the coronary sinus is but the dilated part of the coronary vein.

Personal observation causes me to differ from the above-named authors as to the homologue of the sinus. It is my opinion that the coronary sinus is the persistent primitive left Ductus Cuvieri, and that the left precava or left azygos, when they exist as well as the great coronary vein empty into it; thus sending their blood through it to the heart. The great coronary vein empties into the sinus, and not in one case into an azygos, in another into a cava, again directly in the auricle. In support of this, Bardeleben says "the left azygos as well as the left precava, when present, empty into the sinus. That piece of vein under discussion is the left Ductus Cuvieri, which does not disappear in any mamaml."

The Oblique Vein of Marshall.—It was surprising to find that

the oblique vein of Marshall, which occupies the place below the pericardium that the left precava does when present, is not shown in the illustrations or mentioned in the works of Owen, Wiedersheim, Howell, or Wilder and Gage's Technology. Not sending branches into the substance of the heart, it is not, as older anatomists thought, a branch of the great coronary vein. Although said to be improvided with a valve, I found one over its orifice in the heart of the monkey (*Cercocebus fuliginosus*). Marshall holds that the oblique vein of Marshall is the remnant of the left azygos of the fetus. Since those animals that have the oblique vein of Marshall shall have also the termination of the azygos emptying into the left brachio-cephalic, I cannot agree with Marshall in this respect. The embryo heart shows the oblique vein to be the terminal portion of the primitive left precava.

VIVISECTION.

BY FREDERICK GAERTNER.¹

IN this essay I propose to examine the question whether vivisection should be permitted in the interest of humanity and science; and if so, with what restrictions.

Vivisection is the term employed for designating the operation performed with the knife upon living animals. This term, although including operations upon the human being, is applied principally to those performed upon the lower animals, such as the cat, dog, rabbit, guinea pig, etc., even frogs and fishes.

The performing of a surgical operation upon a human being, whether under the influence of anæsthetic or in a comatose or hypnotic condition, is simply one kind of vivisection. Now why should vivisection of the lower animals be prohibited when the same operation is performed upon human beings every day?

What are the objects of vivisection? I answer: first, the increasing of our knowledge of physiology; second, the confirmation of facts previously known; third, the acquisition of dexterity in operative surgery; and fourth, the experimental application of inoculative medicine, including vaccination and preventive and curative inoculation.

Without this process commonly called vivisection the sciences of medicine, surgery, anatomy, physiology, histology, embryology, and pathology would even yet be in their infancy, and in some respects at least would remain forever undeveloped.

Vivisection may be traced back as far as the years 377 and 460 B.C. Hippocrates, the greatest of ancient scientists, was a vivisector. Æsculapius, Celsus, Aulus, Cornelius, and later, Galenus Claudius, and other great ancient scientists, practiced vivisection upon the lower animals, and even upon human beings.

It is too well known to be disputed that Galenus Claudius (Galen), who lived from 131 to 201 A.D., was the first to discover that the arteries in the human body contained blood instead of

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air, as had been previously supposed. How else than by the process of vivisection could he have made this wonderful discovery?

Let me cite a few of the principal benefits that have accrued to physiology, and hence to the art of healing, by means of vivisection. By this course of procedure the doctrine of the circulation of the blood, the lymphatic circulation through the lymphatic vessels, and that of chyle through the lacteals, were established. Thus also our present knowledge of the nervous system and its functions is due to vivisection, since these facts could not have been obtained by the most minute anatomical research. Our present rational modes of treating epilepsy and the various forms of paralysis are due to the experiments of Brown-Sequard, Bernard, and others, upon the living animals.

The causes of the sounds of the heart would never have been understood without vivisectional experiments, and the stethoscope would have been useless in the diagnoses of cardiac diseases. The true nature of diabetes was thus discovered.

The Hunterian treatment of aneurism by ligature is the result of experiments upon the living animal.

The study and application of anæsthetics, one of the greatest boons to mankind, could be pursued only by experiments upon the living animal. Who would regret the suffocation of even greater numbers of animals when he considers the amount of agony and misery saved to man?

If there be a solution—and doubtless there is one—of such questions as the best method of restoring to life one apparently drowned, the restoration of one suffering from apparently fatal effects of chloroform, why chloroform kills, etc., who would regret the sacrifice of the animals necessary for these solutions?

What have been the results of vivisectional experiments during the last century? By means of vivisection the great French chemist and bacteriologist, Pasteur, discovered his wonderful preventive inoculative treatment of hydrophobia.

Dr. Austin Flint, Jr., proved that the liver is an excretory as well as a secretory organ. By comparing the blood drawn from the carotid arteries of a dog with that contained in the jugular

veins he has demonstrated that cholesterine—*i.e.*, the excretion of the liver—is the product of nerve action. Thus he was enabled to study that condition of blood poisoning which results from an abnormal accumulation of cholesterine in the vital fluid.

By means of vivisection we have been led to the present advanced state of knowledge in regard to the processes of digestion, assimilation, and nutrition.

Thus the Old World, leaning upon the staff of experience, is steadily advancing, climbing the lofty heights of science with a firm and certain tread. But we Americans, an enterprising nation, are sitting idly by, shackled by false ideas of humanity, while over our heads hangs an obscuring pall called the laws prohibiting vivisection.

Who are making the great scientific discoveries, the investigations and researches of to-day? Who are advancing every branch of medical and surgical science? Who are the great protectors of humanity? Answer, the vivisectors.

Science cannot advance without the aid of vivisection; therefore vivisection must and will be practiced, in spite of laws and governments. Then why not regulate and control the practice of vivisection, instead of prohibiting it?

Congress should be urged to pass a law making the art of vivisection part of the curriculum of every reputable medical college. Our government should assist and encourage scientific vivisectors in their researches and investigations, just as England, Germany, France, and Austria have done during the last century, by offering capital prizes and honorary medals to scientists, microscopists, and physiologists. Why not? All is in the interest of science, and principally for the protection of humanity against diseases.

But at the same time this process, this science of vivisection, should not be free to every meddler and dabbler in science. It should be practiced only by scientists, such as expert microscopists, physiologists, and pathologists. If an ordinary physician or other learned man wishes to practice vivisection for study or experimental purposes, let him be compelled to do so under the

supervision and instruction of a licensed vivisector at his laboratory, and under his personal observation.

Let Congress authorize the President of the United States to appoint a board of examiners for the purpose of examining applicants for the position of vivisector. Of course such applicants would be no other than expert scientists, microscopists, pathologists, and histologists. Let such a licensed vivisector be connected with every reputable medical college having a pathological and histological laboratory.

I am a strong advocate of anticruelty societies, but at the same time I believe that man has the first claim upon humanity. If the suffering of mankind can be alleviated, is it not cruel to refuse relief?

If the practice of vivisection is properly regulated the suffering of the animal can be greatly diminished. Let the work be done scientifically, with dexterity, ingenuity, and skill, and whenever it is possible let the animal be placed under the influence of an anæsthetic, chloroform or ether.

I have had the opportunity of studying the process of vivisection and its results, during my sojourn in Europe, at Virchow's laboratory, Berlin, Rokitsky's laboratory, Vienna, Pasteur's laboratory, Paris, and the Von Recklinghausen laboratory, Strassburg, and I have witnessed several thousand vivisections, and in each and every instance I came to the conclusion that vivisection is a necessary procedure, and of paramount importance in the study of medicine and surgery, their kindred and contributing branches. It is simply impossible to obtain a practical knowledge of physiology, histology, etc., without vivisection.

To prove that my assertions are correct, and based upon scientific principles, I will narrate a few practical cases in medicine and surgery in which by no other means than vivisection were the scientists able to demonstrate to the medical profession of the whole world that a certain medicine, or a certain described surgical operation, is necessary to save the patient and insure a speedy and complete cure.

Let us consider, first, *surgery*. The various surgical operations and procedures, especially as to their technique, have been

developed and perfected by means of vivisection. Consider particularly the abdominal operations, such as those performed upon the stomach, intestines, liver, spleen, kidneys, etc. The honor of perfecting these operations is due principally to Prof. Billroth, of Vienna, Austria, the boldest surgeon that ever lived. He, in the year 1879, performed for the first time that operation known as gastrotomy, upon a living human being (a woman). This operation consisted of a resection of the pyloric end of the stomach for cancer of the stomach. A complete recovery resulted. (An excision of a portion of the stomach was made, and the intestine was sewed to the stomach.) Of course the original idea was developed by means of vivisection.

Previous to this adventure Prof. Billroth and his assistant, Dr. Woelfler, had performed this operation upon ten living dogs. This was done in order to determine positively, first, whether or not this bold surgical operation was possible and justifiable; second, the best mode and technique of this surgical procedure; third, the rate of mortality; and fourth, the applicability of operative surgery in the treatment of such grave afflictions.

In all the various surgical operations upon the intestines there arose questions in regard to the technique, and principally as to the best application of stitches, sutures, instruments, antiseptic dressing, etc., as to the form, quality, and quantity applied. All these questions and difficulties were answered and overcome by experiments upon living dogs and cats. Excisions of the spleen, of one kidney, and of a part of the liver, were tried time and again upon living animals long before the operations were performed upon human beings with good results.

The various plastic surgical operations, operations upon the muscles, nerves, and bones, operations upon the eye, ear, nose, and throat, were first developed and perfected by vivisectional experiments upon animals.

Some of the more delicate surgical operations, such as castration, oöphorectomy, ovariectomy, etc., were first thoroughly studied and then applied in operative surgery after repeated experiments upon living animals. These experiments and proofs have justified

the surgeons in such bold surgical operations for the relief and permanent cure of such dreadful pathological disorders.

Since the term vivisection includes all experiments upon the living animal, whether the knife is used or not, there is also a medical phase of the question, and here it will suffice to say that the physiological action of all medicinal preparations would never have been thoroughly understood had it not been for experiments upon living animals. These experiments serve to determine, first, the physiological action of a drug or preparation; second, the minimum and maximum dosage; third, the poisonous effects of drugs, and their antidotes; and 4th, the effects of hypodermic injections and inoculations.

To an unbiased thinker I believe I have proved that vivisection is both necessary and justifiable. Even the humanitarian, if he be a sportsman, thinks little of the pain given to animals in the chase. No one objects to the killing of animals for food or for their commercial value, even though the animal die a lingering and painful death. If it is legitimate to slay animals in order to supply food and luxuries, and even amusement, why should it not be legitimate to inflict pain upon or to slay an animal for the higher and nobler purpose of relieving suffering humanity and prolonging human life?

Therefore, again I say, remove the prohibition, but regulate and encourage the practice of the indispensable accessory of scientific progress,—*vivisection*.

AMONG THE PREHISTORIC MONUMENTS OF
BRITTANY.¹

BY ALPHEUS S. PACKARD.

NOT far from the Land's End of France, and adjoining the picturesque coast of Finisterre, a favorite resort not only of French, but also of English and American artists, lie the barren and almost treeless plains of Morbihan, one of the eighty-six departments into which the French Republic is now divided. Morbihan is Celtic for "The Little Sea," and the district is famous not for its scenery, for the landscape is very tame, but for its impressive and mysterious so-called Celtic or Druidical ruins. These remains are mounds, tombs, and monoliths erected by a race whose remote descendants still occupy the soil, their farms and dwellings and hamlets bordering upon, and in part inclosing, the tombs and lines of stone pillars which keep silent watch over the region. The most imposing and best known of these series of pillars or "menhirs" are the great "alignments" of Carnac, which have for centuries excited the curiosity and interest of travelers and antiquarians.

Such monuments, if they ever existed in so great perfection in other parts of France, have been removed by farmers in clearing their lands, or in building their own dwellings, as with us glacial boulders have been removed and used for building stone walls. On the remote coast of Morbihan, however, where the land is comparatively sterile and treeless, and the population is sparse, not only have the monuments been tolerably well preserved, but the Bretons themselves, perhaps speaking a language derived from their pre-Celtic ancestors of the later stone and early bronze age, have preserved in a degree the probable features, the folklore, and some of the customs of the times when these monuments were erected.

Hence a journey to Morbihan, with its weird, somber landscape, its cider-drinking, superstitious, Celt-speaking peasants,

¹ From the *New York Independent*.

clad in their sober black garments, environed by the many mounds, tombs and standing stones, rising as silent witnesses of the mysterious past, and becoming an integral part of the everyday life of the inhabitants,—a journey among such scenes has a strange fascination.

From Paris to Carnac seemed like a journey to Ultima Thule. Ordinary maps in guide-books, and the books themselves, threw little light on this obscure corner of France. Had it not been for valuable information kindly afforded us by Prof. Gabriel de Mortillet, the distinguished founder of the prehistoric section of the vast Museum of National Antiquities at St. Germain-en Laye, who drew a rough map of the Carnac region, together with information given us by Dr. Topinard, the learned successor to the chair of anthropology formerly held by Paul Broca, who freely gave us his personal cards for use among the local antiquarians of Morbihan, we should have lost much time in seeking the most interesting places to visit. We were also indebted for useful suggestions to Mr. Thomas Wilson, who spent part of a previous summer in and about Carnac, and has, in company with M. Gaillard, the chief antiquarian of Morbihan, explored a number of dolmens, and whose article in the *AMERICAN NATURALIST* for July, 1888, was of much aid. Acting on such good and reliable advice, I made M. Gaillard's hotel at Plouharnel my headquarters, and from there made excursions to Lockmariaquer, to Carnac, to Erdeven, and to the Peninsula of Quiberon, thus seeing all the alignments and many of the typical tumuli and dolmens of Morbihan.

A journey in any direction from Paris through Brittany to the Atlantic coast is a delightful one. It was the middle of August, delightfully cool, often misty, to be sure, but with no pouring rain, and often a bright sun,—ideal weather for walking and driving in village carts. Leaving the Mount Parnasse station at eleven in the forenoon, the train shot by Versailles, with its palace, gardens, and surrounding forests, and after taking us through Chartres and Le Mans, left us early in the evening at Rennes, where we slept. Early the next morning we visited the museum of the university, and though it was closed,—it being a

fête day,—the keeper politely gave us a short hour of his time to enable us to see the pre-Celtic and other prehistoric remains of stone, bronze, and iron. Here are amassed the rich vertebrate remains, including the bones of the mammoth from Mont Dol, Brittany, associated with human flint implements, many polished stone axes taken from dolmens; but of especial value are the fine Gallo-Roman remains and the many relics of the Merovingian age excavated from the Necropolis of Caranda. Among the many fine objects in the geological museum of interest to the anthropologist is an immense mass of jade from New Caledonia, perhaps a foot square. Merely glancing at the valuable zoological and art collections gracing the halls of a lyceum in a French provincial city of 60,000 inhabitants, and heaving a sigh at the utter lack of local museums and art collections in far wealthier provincial cities in the United States, we hurried to the station and took the train for Vannes. The afternoon was spent at this strikingly picturesque town, with its ancient timbered houses, leaning over toward each other across the narrow streets in such a social mood; with its mediæval walls and towers, its three notable gateways, its Norman cathedral, and lovely park and flower gardens. It was the *fête* day of the Virgin, and a procession of men and boys, with women and girls, in their white-starched caps, such as perhaps only gather in unique Brittany, filled the square and moved slowly down the incline, closing its ranks as it approached the most ancient of the city gates, the *Porte Prison*, situated between two machicolated towers rising from the town walls.

One should visit the excellent museum here before passing on to Carnac. The *Musée Archéologique* is situated in the third story of a very old, rambling, timbered building, with creaking oak stairs and ghostly corridors. The rooms are small, but the cases contain very rich collections taken from the dolmens and tumuli we were afterward to visit. Here were placed together in the case the relics excavated in 1862 from Mont St. Michel, at Carnac, the largest burial mound in France. It comprises superb series of polished axes in jadeite, chloromelanite, fibrolite, and diorite, with a beautiful necklace of green turquoise. There was

also a fine series from the tumulus of Mané-er-H'roëk at Lockmariaquer, comprising besides six jadeite axes ninety-two of fibrolite, which is a dark variety of serpentine. The pottery of the mound was represented, and among them were seen the rude, unfinished earthenware, precursors of our bowls, tumblers, and cups and saucers. Some of the "green turquoise" heads were cylindrical, perforated, and exactly resembled in shape and color a jade bead we had obtained at Cholula, from a Mexican Indian. The jadeite implements were illustrated by unworked specimens of jade from Thibet, and of jade nephite from Siberia, as well as saussurite from the valley of the Saas.

Reluctantly leaving this quaint and attractive town, we took the evening train for Plouharnel Carnac, reaching the Hotel du Commerce, kept by the two daughters of M. Félix Gaillard, to whom we took a card of introduction from Professor Topinard, and from whom we received every kind of attention and aid, the learned archeologist freely giving us the benefit of his many years' exploration of neolithic menhirs and dolmens, as well as Gaulish burial-places. Part of the hotel is devoted to a very rich local museum, crowded with stone implements, ornaments, and articles in bronze and gold, pottery, including funeral lamps with holes for the wick, and three graves removed with their contents from Quiberon, the whole illustrated by stone implements from North America and New Caledonia, with objects from the Swiss palafitts, or pile dwellings, which M. Gaillard told us are of the same age as the dolmens of France.

And now, before we actually visit these strange memorials of past neolithic occupation, let us explain the meaning of the Celtic names applied to them. The megalithic monuments are rude monoliths of the granite of the Breton coast, called *menhirs*, from two Breton or Celtic words, *men*, a stone, and *hir*, long; they are also called *penlvans*. The menhirs are arranged in groups of from nine to thirteen rows, each row being called an alignment.

The tomb-like structures called dolmens are so named from *men*, a stone, and *dol*, table. They consist of a few large, broad, flat stones set up on edge so as to inclose a more or less oblong space; the larger ones are about six feet high, and covered over

by a single great slab (called table) or several flat stones. The smaller ones are said to resemble tables and altars. Many of those in the Morbihan are approached by covered galleries, which are generally straight, but at times curved; the main structure or chamber is sometimes wider than long. They, in nearly each case, face the east, and were places of sepulture or tombs, being the precursors of the old-fashioned tombs of our cemeteries, and were covered by mounds of earth called *tumuli*. A tumulus sometimes enclosed a cairn or *gilgal*, or heap of squarish stones, six or eight inches or a foot in diameter, thrown or laid over the dolmen to protect it from wild beasts. A *cromlech* in France is a circle or semicircle of menhirs or upright stones. The stones composing a cromlech are usually smaller than the majority of the menhirs, and the stones touch each other, while in an alignment of menhirs the individual stones are from two to several feet apart. The word cromlech is from *kroumm*, curved, and *lec'h*, meaning sacred, or, according to some writers, smaller stones.

There are in the single department of Morbihan 306 dolmens, and throughout France 3,410. They are rarer in the north and east than in central, southern, and western France. Beginning with the most eastern point at which dolmens occur, archeologists have observed them in western India, where they have been used to the present. They are found in Palestine, near the Dead Sea, in the land of the Moabites. Going west, we find them on the other side of the Caucasus Mountains, in Circassia and the Crimea. Passing farther to the westward, they occur in Central Europe, northeast of Dresden, from Mecklenburg through Denmark into southern Sweden, but none occur in Norway. Returning to Germany, many have been discovered in Hanover and the Low Country, as well as in Belgium, in Luxembourg, and Switzerland. They also occur on the Channel Islands, in Cornwall, in the Isle of Man and of Anglesea, some in western and a few in the eastern counties of England, while many occur in Scotland and in Ireland. Turning to the Mediterranean region, there are the ruins of dolmens in Corsica, in northern Spain, in Andalusia, in Portugal, while in northern Africa they are abundant from Morocco to Tripoli, especially in Algeria. Mortillet rejects the

theory once held that the dolmens were constructed by a migratory people, maintaining that they were the work of a sedentary population, and not of one and the same race, as skeletons of very different races have been found in them. At the same time many facts tend to show that the dolmen-builders in the first place came from the east. Mortillet also states that dolmens were burial chambers used as places of sepulture by families or by tribes. The menhirs were also quarried and erected by the designers and builders of the dolmens, who roughly hewed and chipped the monoliths into their present shapes with small axes of polished flint, jade, and the harder varieties of serpentine.

Before we inquire into the traits and customs of the Neolithic tribes, let us glance at the monuments they left behind them.

After breakfast we clambered into a Breton village cart, driven by a youthful latter-day Celt, with M. Gaillard as our courteous guide, and set out over an excellent road, often bordered with the broom and hedged with gorse, past farms and scattered dwellings of stone, through the village of Carnac, with distant views of the Atlantic, dotted with the brown sails of the sardine fishing boats, and on our left overlooked by the tumulus of San Michel, the highest elevation in the neighborhood. The road soon passes over a causeway bordered with salt vats; and after an hour's drive we cross the ferry a little above the fishing village of La Trinité. The ferry, by the way, was an interesting study. Although the amount of travel on this road would hardly seem to warrant it, the road on each side of the arm of the sea was elaborately paved with granite blocks to a point below low-water mark. The boat was a big scow, large enough to hold two carriages, and was slowly, laboriously pulled across by means of a large iron chain.

At the village of Lockmariaquer, which was the site of Dariorum, or of some other Roman settlement, we walk out to the end of the solid granite jetty, whose earliest foundations are attributed to the celts, the Romans afterwards improving upon them. We engage two fishermen to take us in their boats to Gaverne or Gavr'Inis, *anglice* Goat Island, on which is perhaps the most interesting tumulus and best-preserved sculptured dolmen

in the Morbihan, and probably in Europe. With a fair westerly wind and a bright sky we hie on, taking the opportunity to eat our lunch of cold meat, bread, and cider, with a course of excellent, though tiny, raw oysters, which are usually offered at the hotels throughout the coast towns of Brittany. Clambering ashore over the slippery rocks we walk up a lane bordered with fig trees, and ascend the eastern side of the mound, which is a *galgal*, or cairn, twenty-six feet high, and covered with soil overgrown with the broom and prickly gorse.

The view from the summit of the mound, over the Gulf of Morbihan and its shores, is one of much interest, from the fact that some of the distant eminences are artificial mounds, and that on some of the islands there are dolmens. We can look across a narrow passage swept by swift tidal currents to the little ragged island of Er-Lanec, with the remnants of one cromlech, half of the circle on the shore and the other half below high-water mark, while beyond, at low water, can be seen the prostrate stones which once formed a second cromlech. The land, has fallen, and the sea has partly torn down this and all the other islands since the times when the dolmen builders inhabited this region.

Descending, we enter the gallery of the dolmen by a path walled in with the square porphyritic granite blocks taken from the sides of the *galgal*, and, passing through the low, narrow gallery about twenty-five feet long (Cartailhac says thirteen meters) we enter the chamber, which runs east and west. About forty huge slabs form the pavement, the walls, and the ceiling. One of the slabs in the ceiling is of quartz; and we judged the largest slab to be about eighteen feet square. But the distinguishing feature of this dolmen is the mysterious sculpturing on the slabs. All the granite wall-slabs are thus sculptured, the marks being cut in. And what was the nature of the tools? The quartz slabs alone had been untouched. Cartailhac argues, with good reason, we think, that the implements could not have been of iron, as only the softer granite was grooved and engraved, and that the engravings were made with stone tools. It is also noticeable that in other dolmens we visited, symbolic stone axes, mounted on handles, are engraved on the slabs of the ceiling, while on a

single upright slab in the dolmen we are now describing there are eighteen such axes figured, with others in the same gallery.

The marks themselves roughly resemble the tattoo marks of Pacific Islanders. As Cartailhac remarks in his "*La France Préhistorique*" (1889), they are diverse linear combinations, being straight, curved, waved lines, either isolated or parallel or ramified like fern leaves, or arranged in segments of concentric circles, either limited or not, and trimming certain compartments of spirals with short turns, recalling exactly the figures made by the wrinkles of the skin on the palms of the hands and the finger-tips.

The last-described marks are certainly the most typical and abundant, and perhaps were suggested to the proto-Celtic engraver by studying the lines on his hands. The artist was not hurried in his work, and, as Cartailhac says, the sculptures must have been made before the stones were put in place.

But the tide is going out, and we must unwillingly leave this fascinating ruin and return to Lockmariaquer, to visit other dolmens. One of the most notable, situated south of the town near the base of an elliptical mound, thirty-nine feet high, is the dolmen Mané-er-H'roeck (the mountain of the fairy). The opening to the gallery, as in all the other dolmens, faces to the east; and to enter it we pass by two enormous but prostrate menhirs, one thirty-one and the other twenty-five feet long. The walls of the dolmen are built in horizontal layers, and one of the stones raised on the right side of the entrance is ornamented with very beautiful and curious sculptures, some like escutcheons, besides ten figures of symbolic axes with handles. Thence walking across a potato field, occasionally stopping to pick up fragments of Roman tiles, we approach the "king of the menhirs," called Mane-ar-Groac'h. His monolithic majesty is second in size and height to none in Europe, or any other country; the next largest one in Brittany being thirty-seven feet high. It lay however, prostrate, and broken into four pieces. When entire it was sixty-seven feet six inches long, seven feet six inches thick in one diameter, and thirteen feet six inches in the broadest portion. This colossal menhir, as usual when one or two stand

alone, served as a monument, and was evidently in direct relation to the tumulus and the inclosed dolmen, for we noticed one standing sentinel over a dolmen; and they are sometimes erected on the summit of a tumulus, as at Ile de Sein; in such case they may have been put up to indicate burials. The dolmen near the base of the Mane-ar-Groac'h is a famous one, and, like many of the others, has been purchased and restored by the government. It is the Dol-ar-Marc'hadourien, or Table of the Merchants. On the under or inner side of the great table or covering slab, which is twenty feet long by thirteen feet wide, was engraved a large stone symbolic hatchet with its handle. That these images are in reality rude representations of hatchets seems plausible. Stone axes, apparently made expressly for ceremonial use, are found in nearly all dolmens, having been placed there by the side of the dead; and they are in nearly all cases beautifully finished, with sharp, unbroken edges, and often of jade, which is only now to be found in Asia and Polynesia, being one of the rarest minerals in Europe. Some authors suppose that the axe was regarded by the people as the symbol of separation, an emblem of the end of life. However this may be, whether from its utility alone in every-day life, or its use as a weapon of war, it must have been a highly prized and venerated instrument, to be so often engraved on tombs, and so invariably buried with the dead.

This region is especially rich in dolmens, as they are scattered all about Lockmariaquer; the dolmen of Mane Lud being situated on one of the principal streets, next to a house, the tumulus once inclosing it rising behind.

A little way out from the town is the dolmen of Kervress, remarkable for the cup-shaped pits in the under side of the covering slab, and which, of course, must have been made before the stone was put in place. These cup-shaped hollows are scattered irregularly over the surface, varying somewhat in size, the largest being about an inch and a half in diameter. They are a great puzzle to archeologists, who can make nothing of them. Occurring in Germany, Switzerland, among the Alps and the Pyrenees, and in Portugal, both in dolmens and on menhirs, they had some meaning to the men of the stone and of the bronze

age, after which they ceased to be formed. It is only to be said, with Cartailhac, that at the present day Hindu women at the approach of maternity may be seen carrying water from the Ganges, with which they sprinkle these symbolic cups in their temples with prayers to the divinity indwelling.

Such superstitions still prevail, unless they are of new and independent growth, in France, and in the Pyrenees, in Sweden, as well as in Switzerland, where they are either regarded as the work of elves, or visited by young girls and widows in the hope of getting husbands. The great mound of St. Michel looms up as on our return we approach the little village of Carnac. It is the largest tumulus in France, overlooking the rather flat surrounding country and the Atlantic, with Belle Isle in the distance and to the right the peninsula of Quiberon. The tumulus is now 65 feet above the surrounding fields, though originally it must have been considerably higher, its summit having been leveled by the Romans, who built a temple upon it, while the remains of a Gallo-Roman villa are still visible near its base. In place of the Roman temple stands a humble and not at all interesting chapel, dedicated to St. Michael. We ascend the tumulus by the fifty-two steps made of the small granite blocks taken from the galgal which protected the dolmen, the great elliptical mound of earth covering both dolmen and cairn, being 400 by 200 feet in its greater and lesser diameters. Toward the north and northwest are plainly to be seen the famous alignments of Kerlescan, Kermario, and Ménéac, which we were to visit on the morrow, when M. Gaillard was again our guide, philosopher, and friend. Without his intimate knowledge of these striking monuments we should not have half seen or understood them, and the kindly man, full of enthusiasm and enlightened interest, told us all he knew of the alignments and their probable object. His conclusions seem to us to be in advance of what has been published by the leading French archeologists, who have only made comparatively brief visits to the region. Fortunately the government has for a number of years taken possession of the alignments and most of the dolmens, restoring them by setting the buried or fallen

stones into their original places, so that we saw them under more favorable auspices than earlier travelers.

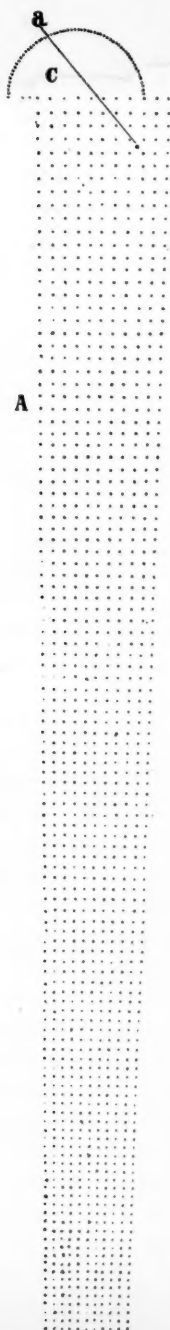
With our old white Breton horse and rickety cart, and youthful Breton presiding over the reins, we again drove through Carnac, past Mont Saint Michel, and turning sharply north at the salt vats, drove through a delightful lane shaded by chestnuts and oaks, with walls of turf overgrown by the gorse, leading to an old chateau, buried from sight by a thick wood. It was just the day for exploring alignments. The same blessed sun which for so many ages had shown upon these same stones while being planted by throngs of Neolithic workmen, perhaps under the inspiration of their priestly leaders,—the same sun shone brightly under the menhirs rising from the gay purple heather which clothed the undulating plain. M. Gaillard had wisely conducted us to the easternmost point, and was now to lead us for three or four miles westward, so that we could review, one after the other, beginning with the thirteen alignments of Kerlescan, and ending with those of Ménéac.

There are at Kerlescan thirteen rows or alignments, comprising 262 menhirs, and extending westward about 1,000 feet. At the western end is a cromlech now restored, which, instead of being semi-circular, is somewhat square, inclosing a space about three hundred feet in diameter. We then visited the interesting elliptical mound inclosing the dolmen of Kerlescan, lying just north of the middle of the group of menhirs, which is exceptional and indeed unique in Brittany from having been surrounded by an elliptical cromlech or circle of menhirs, some of which were six or seven feet high, and placed a few feet apart, not touching each other as in those of the alignment. Then retracing our steps, picking our way back through masses of the prickly, forbidding gorse, which bore an occasional yellow pea-like flower, we examined the cromlech, and, taking to our cart, drove on to the next series of alignments, the larger one of Kermario.

The avenues of Kermario consist of 855 menhirs planted in ten rows, extending over the undulating heath for nearly a mile, or, to be exact, 4,037 feet. The standing stones are impressive for their size and height, some of them being twelve feet high.



PLATE XIX.



ALIGNMENT OF MENEC.

Moreover, an added interest are the traces of Roman occupation on the south side near the western end,—in fact, traces of the civilization of Rome of the period of the Gallic wars are scattered over Morbihan; and the peasants call the alignments *Cæsar's Camp*. Indeed their explanation of these lines is that their patron Saint Corneille was pursued by the Roman army, which was, as a punishment, turned to stone, the taller pillars representing the officers.

After crossing another interval we reach the eastern end of the alignment of Ménéac, whose cromlech, at its western end, incloses some of the farmhouses of the hamlet of Ménéac, which is not far from Carnac. The menhirs lie to the north of the road between Carnac and Plouharnel. The group is a little shorter than that of Kermario, being 3,376 feet long, and consists of eleven instead of ten lines, and the stones are not quite so high and imposing as those of the middle group. The stones or pillars vary much in shape; some are much rounded; many were, however, planted with the smaller end down; and whether it is a mere coincidence or not the highest stone is about eleven feet high, the number of rows is eleven, the alignments themselves are about eleven yards apart, while the spaces between the stones composing each line are often ten or eleven feet apart. In this, as in the other groups of alignments, the rows are not mathematically straight, but more or less wavy, and the stones vary much in distance apart, all the way from perhaps three or four to ten or eleven feet. In general the stones decrease in height toward the end, where they are not much over four or five feet high. The groups follow the natural inequalities of the plain, whose surface is rolling, the country slightly descending from Ménéac to Kerlescan.

The semi-circle of stone or cromlech at the western end of the Ménéac group was inclosed by standing stones from about five to six and even eight feet high, which touched each other. At present many are prostrate, and there are two or three small stone farmhouses within the circle. Fortunately the government purchased the entire group in 1888, and will raise and plant the fallen stones; and as the inhabitants of the houses die or remove, the buildings will be taken down. The restoration of the Kermario

group is nearly accomplished, and is almost entirely inclosed by a low stone wall.

It was hard to leave this weird, fascinating, and impressive landscape, in which the natural features were tame enough, the strange interest being due entirely to the work of the heads and hands of a forgotten and extinct people, who have passed away leaving not a tradition behind them,—only these imposing monuments of stone.

“No priestly stern procession now
Streams through their row of pillars old;
No victims bleed, no Druids bow,—
Sheep make the daisied isles their fold.”

Returning to our hotel to breakfast, we spent the afternoon in exploring the dolmens and alignments of the Quiberon peninsula, accompanied by M. Gaillard, who was so enthusiastic and interested in having us see everything of archeological interest.

The carriage road to St. Pierre, which is a little village situated on the new railway running to Quiberon, passes over a dreary, monotonous waste of sand, and as it runs along the middle of the neck of land reveals few extended views of the ocean. On our way we pass on the western shore, not far from the site of a Gaulish burial-place, from which M. Gaillard had recently exhumed seven skeletons, with bronze bracelets and Gaulish coins and pottery. After visiting the dolmens and tumuli of Port Blanc, on the west shore near St. Pierre, gathering pieces of pottery, bones, and flint chips, and seeing how the ocean has encroached on the slowly subsiding coast, so as to undermine the cliff and the tumulus, which must have been situated much farther inland in pre-Celtic times, we walked over the grassy, sandy wastes back to our cart, and drove past the village of Saint Pierre and its old windmill to the menhirs and cromlech on the shore. How long the rows of standing stones were originally, it is difficult to say, because the coast has sunken and the waves have undermined and overturned the stones at the eastern end. Walking down across the field, where the men, and women, too, were digging potatoes, we stood on the edge of the *falaise*, or sandy cliff, and the tide

being partly out, we could trace some of the lines into the sea. A few of the stones were lying prostrate on the beach, while others beyond were overgrown with sea-weed, and still beyond lay some under the waves. There are in all five lines, which extend in a southeasterly direction for 635 feet seaward. At a distance of about ninety yards from the head stones of the rows, the highest menhirs being about eleven feet, is situated the ruined cromlech which, according to Lukis, was two hundred feet in diameter. We did not attempt to measure it. The group has not yet been restored, and only about a dozen of the stones are still upright.

M. Gaillard had brought his compass with him, and now demonstrated a curious fact to us. He had already called our attention, while visiting the alignments of Kermario and of Ménéac, to the occurrence between certain of the rows of a single menhir, standing by itself, and which has been overlooked, he said, by all other archeologists. In the alignments of Kerdescan this mysterious odd stone is situated, we think, between the seventh or eighth space between the rows. It is about eleven feet high, and from nine to ten feet thick at its greatest diameter, which is not far from the top, the stone being smaller at its base. In the alignments of Ménéac the single menhir is in the third space from the northern side; namely, between the third and fourth rows of planted stones. In each group of alignments, at least in four of them, this odd menhir occurs, though varying in situation, depending apparently on the position of the rows, none of which are exactly in an east and west course, as their builders had no compass. They are all situated not many paces—perhaps fifty, more or less—from the cromlech.

Now our friend and guide took the greatest interest and satisfaction in placing his compass on one of the middle stones of the cromlech at St. Pierre, and demonstrating to us that the line of 50° (it varies from 45° to 50° in different groups of alignments) intersects the single menhir. M. Gaillard has been here, as well as at the other alignments, at sunrise on the morning of the longest day in the year, the 21st of June, has placed his compass on this menhir, and at the moment the sun appeared above the horizon the odd or single unaligned menhir was seen to be in line with

the median stone of the cromlech and with the sun. It is therefore inferred, and very naturally, that the designers and builders planted these stones in accordance with a fixed plan, and that the inclosure must have been the scene of some ceremony at the time of the summer solstice. And this confirms the idea insisted on by archeologists, among them MM. Cartailhac and Gaillard, that the groups of standing pillars were planted after a common design and nearly at the same epoch, and that the people who erected them were possibly worshipers of the sun, having brought with them from the far east, their original home, the cult so characteristic of eastern races. On the morning of our last day spent in the Morbihan—and what soul-stirring and awe-inspiring days they were, with the charm of the fresh Atlantic breezes, and the bright sun lighting up the heaths and plains, the quaint costumes and dialect of the peasants lending an unusual human interest to the scene—we drove to the dolmens and alignments of Erdeven, through a region of lilliputian farms. The property of the country people is chiefly in land, and the farms handed down from one generation to another becoming gradually halved and quartered, though many were triangular or polygonal in shape, until some of them seem scarcely large enough to support a sheep or cow, or to afford room enough for even a small potato patch. Moreover, they are hedged in by high turf walls overgrown with gorse, one of the most forbidding of prickly plants. Some of the farms were inclosed in turf fences, perhaps four or five feet high, with the corners elaborately built of stone.

The largest of the dolmens in Brittany is that of Crucuno, called *La Roche aux Fées*, or the Stone of the Fairies. A farmer had built his house next to it, and the dolmen, by no means of fairy-like proportions, was used as a cow-house until its purchase and restoration by the government. It is twenty-four feet long by twelve wide, and one can stand upright in it. From this impressive dolmen a path, which a boy will point out for a slight cupreous gratification, leads across the fields to the very remarkable dolmen of Mané-Groh, which is galleried, and besides the principal chamber, has four lateral inclosures.

We shall now dismiss the dolmens, which are so numerous and interesting. They are regarded as the tombs or burial-places, possibly in some cases ossuaries, of tribal chiefs and their families. They were opened at intervals, perhaps for the interment of the successors of the warriors for whom they were first built. Many of them have a circular hole in the stone door a little over a foot in diameter, too small for the passage of a body, and probably used for the deposit of food for the service of the departed in his wanderings in the other world. It is not improbable that our pre-Celtic, neolithic ancestors brought with them from their eastern homes the observance of burial rites, and very primitive religious ideas, involving some notion of a future life, besides the worship of their ancestors and of the sun.

On the whole the Erdeven group of alignments is more impressive than the others, on account of the greater length of the rows, the larger, higher stones, and their greater number, 1,120 having been counted by M. Gaillard. They extend over the rolling plains a distance of more than two kilometers, or over a mile,—viz., 6,886 feet. One of the standing stones near the western end is nineteen-and-a-half feet in height, and two others a little over twenty feet high; one of the prostrate stones is called "the sacrificial stone," but the furrows in the surface seem due rather to weathering than to artificial means.

Could one stand at or near the head, and overlook the entire group of alignments, the impression made would be of course more striking than at present, since many of the stones have fallen, and the lines are much broken, while they make a turn to the southeast near their middle. But as they stand, the longer the observer lingers among them the more impressive they become; and not to see the alignments of Carnac and of Erdeven is to miss one of the wonders of the world. They rank in importance and interest with the ruins of Central America and of Mexico, and the so-called Pelasgic walls and burial-mounds of Greece, while they are by far the most imposing relics of prehistoric times.

Rows of standing stones are not, however, confined to the Morbihan; the menhir-erecting and dolmen-building race, judging

by the monuments it has left behind, existed in other parts of France and of the Old World. According to the latest and most trustworthy authority, M. Cartailhac, whose work entitled "*La France Préhistorique*" appeared in 1889, there are in Morbihan eight of these groups of alignments, including the cromlechs connected with them, and nine, far less important, in Finisterre, five in the department of Ille-et-Vilaine, and six or seven others, of small size and slight importance, in the rest of France, most of them only forming one or two short rows of standing stones. Mortillet says there are in France fifty-six alignments, in fifteen departments. Analogous to the alignments in France are the Sarsden Stones in Berkshire, England, which are composed of 800 menhirs.

Solitary standing stones or monoliths of a later age occur in the Pyrenees, in Corsica, and in Northern Africa, and at present the natives of Madagascar and the Khasias of Northwestern India raise stone columns around their tombs; but these are analogous to the solitary menhirs planted near the dolmens, or those composing the cromlechs, surrounding dolmens, or tumuli. Whether of original prehistoric growth or a later development, the solitary menhirs are in Thibet and in other lands venerated as symbols of the reproductive powers of nature. Finally, we have the solitary obelisks of Egypt, and the monumental stones of mediæval times, which have survived to our day in the granite shafts and marble columns memorizing great national events, or sacred to the memory of the departed.

The alignments were not made spasmodically, at irregular intervals, one stone after another being set up during a long period, as in a modern cemetery, but they were evidently built at one period after a fixed design or pattern, to which all conform. Those of Morbihan and of Finisterre were undoubtedly planted at the same time by the same people,—a race animated by other ideas than those of living merely an animal existence. It is not probable that they were memorials of some conquest or other event of great importance. It seems natural to conclude that these vast and imposing relics, whether we consider the size of the stones themselves, their enormous number, their repetition

over a not very extensive region, and their similarity of plan and contemporaneity with the dolmens, were the outcome or tangible expression of the religious nature of the pre-Celtic mind. The people had, long before starting on their westward migration, emerged from savagery, and after centuries of physical and intellectual effort, having peopled Europe, now strong in numbers, and dominated by lofty conceptions and wonderful zeal and industry, had met together, and working, as if impelled by a common inspiration and impulse, under the direction of their priests, raised these unique monuments. The population must have been dense; it was not now migratory, but an agricultural as well as pastoral people. The materials for the dolmens and menhirs were not far off. No traces of quarries have survived, because the Atlantic, in conjunction with the plutonic forces at work in the earth's crust, has lowered the coast, and washed away all traces of these mighty workers in stone. As we noticed in the materials of some of the dolmens and menhirs, the rock is a porphyritic granite, with oblong crystals of feldspar and scales of black mica, readily rusting on exposure to the air. On the cliffs at the ferry, on the way to Lockmariaquer, we noticed the rock in place. It readily and naturally breaks by the action of frost into square or oblong blocks, fitted either for monoliths, or for the small, squarish blocks with which the galgals were formed.

More industrious and inventive than savages, they made use of their oxen, and, whole families or tribes coöperating, the busy multitudes, swarming like bees, with the use of stone axes and chisels, and the aid of fire, quarried the big slabs for the dolmens, and the monoliths for the alignments. They probably moved them on rollers a few hundred yards, or even one or several miles, inland, and then, with a skill developed by long experience, and probably after many a bitter failure, set the stones in place. Some of the menhirs stood on the surface, without any foundation; in other cases foundations for them were carefully laid. So long have they stood that all marks of quarrying have been effaced by the agency of the atmosphere. As Wilson states, a menhir in the headline of the Erdeven alignment, which had been overturned and used as a fireplace, though with tool-marks on it, and buried

during Roman occupation, must have remained prostrate from fifteen hundred to nineteen hundred years; "yet it had previously stood on end long enough a time for the top to become so weathered as to be plainly distinguishable from the bottom."

What, then, was the use of these remarkable monuments? No burials took place among them. The chiefs and their families were deposited at death in the dolmens. The question is still an open one, the best archeologists differing as to whether they were monuments to the dead, or whether they were temples. The common design pervading all the larger alignments, showing that they were erected at the same epoch, forbids one accepting the view that they were simply commemorative of different persons, that they were a kind of archive, each stone recalling a fact, a person, or a date. The remarkable care observed in burying the dead proves that these people were strongly religious. The care taken to put in the proper place the odd stone, and its relation in the summer solstice to the rising sun, indicate that the alignments were erected for the worship, on stated occasions, of the sun. M. Gaillard told us that he believed the menhirs were erected by this early race as monuments to their ancestors. The English archeologist, James Miln, who lived for many years at Carnac, and who founded and built the interesting local museum which bears his name, tells us in his "*Fouilles Faites a Carnac*" that after taking into account the association in this region of menhirs, of alignments, of cromlechs, and of dolmens, he concludes that "these monuments are the debris and the remains of an immense necropolis," and perhaps this is the more natural and logical view to hold. At the same time, while this involves the worship of their ancestors, the sun may also have shared in their adorations.

Judging by the contents of the dolmens, some bronze bracelets and other articles having been found in them, these megalithic monuments were erected during a period of transition from the stone age to the age of bronze; and they are supposed to be contemporaneous with the pile dwellings of the stone age of Switzerland. Who were these stone axemen, these neolithic stone masons, who could with their polished celts quarry, and could

transport monoliths weighing more than some of the obelisks of Egypt, the great menhir of Lockmariaquer being nearly 68 feet long, and weighing 240 tons? Were they genuine Celts? Prof. Gabriel de Mortillet says no. "All these primitive monuments formerly bore the collective name of Celtic or Druidical monuments. It was supposed that they were peculiar to the Celts, and raised by their priests, the Druids. It is a great error. These monuments are found in abundance in regions which have never been occupied by the Celts, as Denmark, Spain, Portugal, Morocco, Algeria, etc. They are even very probably in greater part anterior to the great Celtic invasions; and if they attracted the attention of the Druids, it was only when they were already partly in ruins and lying on the surface of the soil" (*"La Préhistorique Antiquité de l'Homme,"* 1885).

Cartailhac, in his excellent work on Prehistoric France (1889), also says that we must abandon the views of the older archeologists, who believed that these were Druidical monuments, and should be attributed to the Gallic or Celtic race, or to any single race of emigrants from the east. Within twenty years, owing to the rapid course of discovery in France, so many dolmens having been opened, in which were found the skeletons of different races, the tendency among the most experienced French students is, with Mortillet, to deny any special ethnic value to these monuments. For example, De Quatrefages discovered the bones of two races in the same dolmen, and Hamy has demonstrated that the population of France was almost as much mixed during neolithic times as to-day. Cartailhac concludes that the problem of the megalithic monuments is exactly that of the advanced civilization of Europe, which even in prehistoric times became almost universal, and which is called neolithic. "Did it," he asks, "reach our country with new races or populations? Was it spread by contact of one people with another? We have no response to make to these questions. The truth is probably scattered throughout all systems, and that which is true for one country will be inexact in another."

All archeologists, however, agree that these monuments were erected by the neolithic race or group of races, who used pol-

ished stone axes, and that this complex of races originated in the east, perhaps between the Caspian and Black Seas, migrated into Europe, bringing with them the cereals, flax, and the domestic animals and burial practices, and that they had religious ideas. As compared with the paleolithic races of the Old World, or those who were simply hunters and fishermen, and were of a purer, more savage, and primitive race, the neolithic peoples were a most composite type. To narrow down the problem, the French archeologists acknowledge that the megalithic monuments of France were of the same age as the pile-dwellings at Robenhausen, near Zurich, which are of the polished stone age. It is well known that the lake-dwellers of Switzerland, as the centuries went on, received from the east and south bronze implements, and a knowledge of the art of making bronze tools. It is also known that the dolmens of Northwestern France were still used as places of burial as late as the beginning of the bronze age. Hence it seems natural to infer that the people who built these monuments were the ancestors of the Celt-speaking Welsh, Irish, and Bretons. The Robenhausen civilization was not probably much older than that of Egypt; and it seems reasonable to suppose that the menhirs and dolmens of France were of recent age, compared with the troglodytes of Spy and Neanderthal, the cave-dwellers of Cro-Magnon, of Dordogne, and of Kent's Hole or the men of the Mentone rock-shelters.

At all events—and this is the great charm of such inquiries—the problem is as yet unsolved. We may wander up and down these alignments, so weird and awe-inspiring, and speculate as to what manner of men were their builders. Few places in the world are enveloped in such an atmosphere of myth and doubt. The very people now inhabiting these stone-studded plains, perhaps their remote descendants, speak a semi-fossil language, go about among these monuments of the dead in a funereal garb of black, still cherish a few pagan, almost prehistoric, superstitions. They can readily talk with Celtic, Irish, and Welsh, but French is a foreign language to them; and, in short, they are a link between the present and the age of stone. Many English travelers visit this strangely interesting region. Why is it that so few Americans care to wander to the Morbihan?

THE DOUBLE MONSTER ROSA-JOSEPHA BLAZEK.¹

ROSA and Josepha Blazek were born January 20th, 1878, a Skreychov, in Bohemia. Their birth, which seems to have taken place without any difficulty, was accomplished under the care of a village nurse.

The mother, aged twenty-two years, had been delivered, two years previously, of a well-formed and healthy daughter. The parents are sturdy peasants, of some means, but of limited intelligence. Until recently they have been opposed to a public exhibition of their children.

A short notice printed at Prague in 1878 shows that six months after their birth they were visited by M. Auguste Breisky, then a professor of the German Faculty of Medicine of that city, and director of the Gynecological Clinic. After an examination, M. Breisky stated that the development of Rosa-Josepha was in accordance with their age. M. Marcel Baudoin relates that soon after their birth the parents, horrified, took the advice of an old woman, and left them eight days without food, expecting them to die.

At first sight the sisters Rosa-Josepha give the impression of two little girls, rather small for their age (now thirteen years), very blonde, slightly pale, with a gentle, amiable manner, and eyes somewhat languid in expression. On seeing them sitting side by side on the same footstool one would hardly suspect their union when they are dressed; but if one makes the slightest movement the other follows immediately.

The trunks are not parallel, the axes of the vertebral columns diverging perceptibly, making a large V, the apex of which corresponds to the union of the pelves. Each trunk is bent on itself at an angle of 45°, to give the faces their proper positions. Moreover, the heads are inclined a little toward each other, for the same reason. The contact of the trunks is less—although Rosa-Josepha is only thirteen years old—than that of the double mon-

ster Millie-Christine, aged twenty-two, in whom the right shoulder of one individual touches the left of the other.

The faces of these two little girls closely resemble each other; they have a rather old and worn appearance, but the mental and physical strain to which they have been subjected since leaving their own country would account for this to a certain degree.

In figure the resemblance is extraordinary,—much more so than between ordinary brothers and sisters, and even more than is often the case between twins of the same sex.

It is only when one examines them in profile that it can be seen that they are united by the posterior pelvic wall as completely as the famous Hungarian pygopage, Helen-Judith, descriptions of whom may be found in all the old works on monsters.

The angle formed by the bodies—the point of the V representing the trunks—is made by the intimate union of the sacral and coccygean regions at the center, and those of the four nates by the lateral parts. One finds there a real saddle, of which the bony skeleton resembles a wooden saddle similar to those of the Breton horsentien. There is a single pelvis of exaggerated size, consisting of four iliac bones, to which are attached the four legs, which are well formed, if one can judge from the gambols in which these young persons indulge without difficulty.

Beneath the sacral conjunction, in a quadrilateral, dome-like space, limited by the origin of the four lower limbs, there is found a region the description of which is of the first importance in the history of monsters. In the language of a German gynecologist who is very exact on this point, and also of M. Isch-Wall, there would seem at first sight to be a single set of organs; one urethra, one uterus, and one anus. It is certain, however, that there are two bladders, for a desire to urinate is not felt by both individuals at the same time; in this they resemble other pygopages, and it is easily understood if one believes that the allantoides are formed when the union of the embryos takes place, and by reason of their very anterior situation, they are not close to the point of contact, which is posterior.

The other internal genital organs are double.

The rectum is probably single for some distance, as they are actuated by a single impulse to defecate; but there are undoubtedly two large intestines.

According to Breisky, at the age six months there was a remarkable asymmetry of the heads of the two children, very noticeable if one looked at them from above or behind.

As regards psychological phenomena, it is now well known that monsters of this kind constitute two distinct personalities, and that one has to deal with individuals where brains function entirely independently of each other.

The two girls speak "Czech,"—that is to say, the language of their native land. They can occupy themselves in many ways independently of each other. One sleeps while the other is awake. The showman relates many amusing stories about the different sensations that they experience, but these need to be verified. It has been proved, however, that they have not the same tastes in the matter of food. One likes beer, the other wine; one is fond of salad, the other detests it, etc., etc.; when one is thirsty the other does not necessarily experience the same sensation.

The two hearts do not beat in unison, for the radial pulses are not synchronous.

With Millie-Christine, Paul Bert demonstrated that a touch on the lower limbs of one individual was perceived by the other; whence it was concluded that the *cauda equina* of the spinal marrow were united. It does not seem to be so with Rosa-Josepha; there is only a very restricted zone in which a sensation may be experienced by both at the same time, and this zone corresponds to the middle part of the skin which covers the transverse mass placed between the pelves,—a place where it might be possible to separate the two girls if it should become necessary through the death of one of them. It can be inferred from this that the union is less intimate than in the case of Millie-Christine, and that if the spinal canals communicate at the level of the sacrum—which is probable—the cords are either not united at all or but slightly.

The movements are supple and graceful. When one walks the other does not have to walk backwards. Progression takes place in many ways that would take too long to describe here. Ordinarily, as with Millie-Christine, the two internal feet advance together, then the two external ones. Rosa-Josepha can walk, each by herself, the one carrying the other. The walker throws herself a little in advance, the one who is carried resting on the other's hip, having only to lift her feet a little from the ground. Sometimes they walk on three legs, or even two, going up stairways, and practicing the dancing lesson which is given them every day.

The pathological history of their pygopage would be very interesting if it could be exactly known. It is on record that one of the children was sick, when a year old, with croup which the other did not have. Shortly after the well individual was seized with convulsions, which did not attack the one which had had the croup.

The case of Rosa-Josepha is not entirely analogous and comparable to the two other pygopages, Helen-Judith and Millie-Christine. The former, who has disappeared from public view since 1874, had the spinal cords united, but in Rosa-Josepha this does not seem to be the case. In other respects these two girls resemble Helen-Judith, and they probably constitute a type intermediate between the latter and Millie-Christine.

EDITORIAL.

EDITORS, E. D. COPE AND J. S. KINGSLEY.

THE question is often asked the editors, With but limited funds, what journals related to biology should our college take? As others may be in the same position as these inquirers, the answer is made here. Of course this journal should occupy the first place, since it is the only American periodical which regularly presents abstracts of the more important papers in all departments of natural history. Next in importance is the *Journal of the Royal Microscopical Society* (London, \$7.50 a year), which, besides one or two original papers in each number, contains abstracts of work done in botany, zoology, and in microscopy and microscopical technique. The *Zoologischer Anzeiger* (Leipzig, \$4) presents every two weeks original communications upon zoology, and also a classified list of all zoological publications from all parts of the world. The *Anatomischer Anzeiger* (Jena, \$4) contains only anatomical and embryological papers, and an index to the current literature of those subjects. The *Biologisches Centralblatt* (Erlangen, \$4) is made up of original communications and longer résumés of zoological and botanical papers.

In the line of botany every library should have the *Botanical Gazette* (Crawfordsville, Indiana, \$2) and the *Bulletin of the Torrey Botanical Club* (New York, \$2). For the larger and more important papers the *Annals of Botany* (London), the *Annales des Sciences Naturelles Botanie* (Paris), the *Botanisches Centralblatt*, and the *Jahrbücher für wissenschaftliche Botanik*, are the most indispensable.

For the original contributions to zoology the most useful are the *Journal of Morphology* (Boston, \$9), the *Quarterly Journal of Microscopical Science* (London, \$10), the *Zeitschrift für wissenschaftliche Zoologie* (Leipzig). Where more funds are available this list can be indefinitely increased.

—THE organ of the Brooklyn Entomological Society, *Entomologia Americana*, has ceased with the completion of its sixth volume. In the years which it has been running it contained a number of valuable papers on entomology, and especially was it noted for its synopses of the various groups of insects. In another aspect the demise of the journal is not to be regretted, for its editors apparently allowed everything that came to be published, and the result was that each number contained several articles each about a page in length. Such a course does not advance entomology; it is rather a drag upon it, for no one can by any possibility keep track of the multitude of short notes thus poured out, and by-and-by there may be quarrels resulting because somebody's ten-line squib has been overlooked. *Entomologia Americana* was, however, not alone in this fault.

—UNIFORMITY is in many respects desirable in many things, but uniformity may result in deformity. What a world this would be were all men to think alike! The editors of the AMERICAN NATURALIST have their little differences of opinion, but this does not interfere with the conduct of the magazine. For instance, one of our number exhibits tendencies towards a strict uniformity in geological nomenclature, while the other is more conservative, and perceives deformity in the uniformity of the newly modified names of the geological (geologic) ages. Triassic and Jurassic are good and long-accepted terms, but Siluric and Cretacic have a barbarous sound. Carbonic has a flavor of the deadly CO_2 ; and then Cambric!—it recalls handkerchiefs and pillow-slips, and anything except ancient Wales. However, the advocates of the new "terminatology" are not thoroughly consistent. Ancient roots should not stand in the way of Eocic, Miocic, Pliocic, and the like, when uniformity is to be gained.

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UDDEN, J. A.—Megalonyx Beds in Kansas. Ext. *Am. Geol.*, June, 1891. From the author.

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WALLACE, A. R.—Natural Selection and Tropical Nature: Essays on Descriptive and Theoretical Biology. Published by MacMillan & Co., London. From J. B. Lipincott Co.

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RECENT LITERATURE.

Geological Survey of Arkansas, 1889.¹—This volume of the Geological Survey's reports relates principally to Crowley's Ridge,—the only marked topographic prominence in the country between Little Rock and Memphis, the geology of which is most admirably discussed by R. Ellsworth Call, who contributes, also, notes on the forest trees of this region, and a description of a new mollusk, *Mytilus harnatoides*, from the Tertiary of Eastern Arkansas. Prof. R. D. Salisbury has a chapter upon the relations of the northern drift to the Plistocene deposits, where he clearly sets forth the succession of events in the northern part of the United States during Plistocene times, and points out the relations of those events to the influences that shaped Crowley's Ridge and its adjacent territory. A valuable paper from Prof. F. H. Knowlton, on the "Fossil Woods and Lignites of Arkansas," and a brief explanation from J. C. Branner as to the origin of Crowley's Ridge, make the report on this region of Arkansas complete.

Zoological Geography.²—The study of the zoological distribution of animals is one which is making continual advances. It is with the view of presenting the principles of this science in a comprehensive yet brief and simple manner that M. Trouessart has written this book. It is one of the *Bibliothèque Scientifique Contemporaine* series, and, like the others of that admirable set, is well illustrated with pictures, diagrams, and tabulated statements to express at a glance the author's meaning.

In general, the greater divisions established by Sclater and Wallace have been followed, but some changes have been necessitated by the progress made during the last five years.

In chapters I. to V. the author describes the great continental regions which have been distinguished according to the distribution of the higher vertebrates. Chapter VI. is a study of the means of the dispersion of animals, both by their own locomotive powers and by agencies outside of themselves. Here, also, will be found a sketch of the faunal characters of the different regions,—a branch of the subject

¹ Annual Report of the Geological Survey of Arkansas, 1889. Vol. II., "The Geology of Crowley's Ridge," by R. Ellsworth Call, M.S.

² La Géographie Zoologique. Par Le Dr. E. L. Trouessart. Librairie J. B. Bailliere et Fils, Paris.

too often neglected. The second part (chapters VII. to XI.), describes in detail the successive and regular distribution of each class of animals, the classification being based on their means of locomotion. In the last chapter the author calls attention to the relations existing between paleontology and zoological geography.

M. Trouessart is to be congratulated for the masterly way in which he has presented the subject, and on his success in popularizing it.

The Ancestors of Our Animals.³—This exceedingly attractive little book is one of the *Bibliothèque Scientifique Contemporaine* series. In it Dr. Gaudry has combined the ideas concerning the origin and development of animal life previously published in scattered articles. There is a resume of his works on Pikermi and the Leberon which will be appreciated by students who have been unable to procure the original volumes. Finally a chapter is devoted to the paleontological work done in the Museum of the Jardin des Plantes. M. Gaudry has introduced many figures to illustrate the text, many of which are restorations, and give the general reader a better idea of the animal than could be obtained from the fragments of bones which mean so much to the student. The book is a capital demonstration of scientific facts made popular. Prof. Gaudry states that he has been materially assisted in this work by M. Marcellin Boule.

Morphology of the Avian Brain—This is the title of by no means an unimportant contribution to the first volume of the *Journal of Comparative Neurology*, of Cincinnati, by Mr. C. H. Turner. The memoir includes over fifty octavo pages, and is illustrated by five plates, three of which are folding. They present many figures of brains, of divers views, of different birds of this country. There are also sectional microscopical views. Mr. Turner informs us that his investigations are based upon the study of "over one hundred and fifty birds, belonging to nine orders, twenty families, more than forty genera, and about fifty species." A brief but clear account of his methods of research is given, and this is followed by his remarks upon the external form of the bird's brain in general, followed in turn by sections devoted to descriptions of the various parts, as the rhinencephalon, the prosencephalon, the hemispheres, the mesencephalon, the diencephalon, the epencephalon, the metencephalon, and finally the cranial nerves. Measurements and ratios of all these structures are given under the

³ Les Ancêtres de nos Animaux dans les Temps Géologiques. Par Albert Gaudry. Libraire J. B. Baillière et Fils, Paris, 1888.

various divisions treating of them. He republishes Coues's description of the cranial nerves as presented in his second edition of the "Key" to North American birds, and states that he is in error when he says that the "optic lobes are never covered" in the avian brain by that part of the encephalic mass above them (p. 50).

In the second section is discussed the "Relation of Brain Measurements to Taxonomy," wherein the classificatory schemes for birds given by Huxley and Parker are contrasted, and a special table treating of the taxonomy of the North American Passeres as it has been given by Coues, the A. O. U., and by Shufeldt, is also presented.

Mr. Turner supports the views of Shufeldt with respect to the position in the system of the Corvidæ, the Icteridæ, the Fringillidæ, and the Turdidæ, and departs but slightly from him in the other families. In giving the Paridæ a high place, he agrees with Coues, but gives Shufeldt due credit for having long ago pointed out their being a very highly organized group of birds.

Although the present writer has adopted, in one or two instances, the exhibition of the affinities of families by means of tabulated serial lists, I must say here that upon the whole the scheme is very deceptive and often misleading. It is very much like an attempt to show the mode of growth and branching of a tree by similar means. It is quite out of the question. I consider that we have twenty families in the group Passeres in this country, and Mr. Turner has dealt with but *ten* of them. Further investigation may induce him to recast to some extent his taxonomical scheme of the North American Passeres, and we trust that such studies will soon be forthcoming.

Space will not admit of my giving Mr. Turner's valuable recapitulation of his observations upon the avian brain here, and I must be satisfied with this brief notice of a paper that will well repay the careful reading of all those interested in vertebrate morphology, and in the structure and natural classification of birds in particular.—R. W. SHUFELDT, *August 10th, 1891.*

General Notes.

GEOGRAPHY AND TRAVEL.

CHATHAM ISLAND, GALAPAGOS ARCHIPELAGO, Aug. 28, 1891.

Having returned from a trip of two months through the Galapagos Islands, I take the opportunity to send you a few lines about the progress of the expedition. As you know, Mr. C. F. Adams and myself left New York on May 1st. Having direct connection at Panama, we reached Guayaquil May 13th. Unable to find any convenient ship to take us to the islands, we had to stay at Guayaquil until June 1st, on which day we sailed on a schooner to Chatham, the most eastern island of the group, on which the hacienda of Senor Manuel Cobos is placed. We arrived at Chatham June 9th. Here we remained, examining the island and making extensive collections, until June 26th. From this date to August 26th, when we returned to Chatham, the following islands were visited: Charles Island (stopped at three different ports and went over the whole island), Hood, Barrington, South Indefatigable, Brattle (not landed), South Albemarle (opposite Brattle), Grossman (not landed), Duncan, West Indefatigable, Jervis, East Albemarle (opposite Cowley), West James, North James (two different ports visited), North Chatham, West Chatham.

On the second trip we intended to visit the following islands, and all arrangements had been made: Tower, Bindloe, Abingdon, West Albemarle, Narborough, Weismann, and Culpepper; but on my return here I found news from home which necessitated my return at once. Therefore I proposed to make only a short visit to the most important of the above islands—Tower, Bindloe, Abingdon—on my return to Guayaquil.

The following collections have been made: Mammals, birds (so far about 600 skins prepared by Mr. Adams, and the same number in alcohol), reptiles (many hundred specimens, complete series of *Tropidurus* from all islands), spiders, land shells, insects, etc. The flora I have collected as much as possible of every island touched at.

No mammals had been collected on these islands since Darwin's visit in 1835. Mr. Adams shot a bat on Chatham (the first one ever collected) and saw one on Albemarle. *Hesperomys* was secured on

Barrington (eight specimens), South Albemarle (one specimen), Duncan (one specimen), East Albemarle (one specimen); on Chatham one was observed. There cannot be any doubt that this mammal is an original inhabitant of the group.

The birds are exceedingly interesting, and I hope to be able to give a satisfactory solution of the *Geospiza* question. As I have shown in a paper published in the *Biologische Centralblatt*, the Iguanoid *Tropidurus* is represented by a single species on each island, and nearly every island contains a different species or race of *Tropidurus*. This has been absolutely sustained. Now in the plastic genera of birds we find exactly the same. Let us first consider the genera *Nesomimus* and *Certhidea*, of which only a single species is found on each island. The genus *Nesomimus* is represented by a different species or race on every island, and there is never more than one species or race found on one island. The same is true of *Certhidea*, but this genus is not quite so plastic. On Hood, as it is known, *Nesomimus* is much different from the other species; but so are *Certhidea* and *Tropidurus*. On the central islands—Chatham, Indefatigable, Jervis, James, Albemarle—*Nesomimus* shows only slight differences; but so do *Certhidea* and *Tropidurus*. What I want to state is the absolute harmony in the distribution and the grade of difference in these forms. This is also true of the flora, as far as I could make out.

It is now necessary to examine such genera as *Geospiza*, *Camarhynchus*, and *Cactornis*, which are represented by a greater number of species on one island. As it is well known, there has been a great uncertainty as to the number of species found on each island; on some islands not less than eight species have been recorded.

So far as my present investigation reaches, probably on none of the islands visited is the number of species greater than three; but these three species vary nearly on each island, each separately, as if they would represent three different genera. The same view I have for *Camarhynchus* and *Cactornis*, and all such genera which contain more than one species of a genus on a single island,—like *Bulimus*, for instance. But often we find that the highest number of species is not reached by every island, but that the number of species is reduced. This can be explained by the extinction of one of the species. In this respect I have first to make some remarks about *Nesomimus*. As is known, *Nesomimus* existed on Charles Island in 1835 when Darwin visited the island; it still was found there in 1868 during Dr. Habel's visit. We did not see a single specimen on Charles Island, notwithstanding the whole island was crossed and three different ports were

visited, and there is hardly any doubt that *Nesomimus* is extinct on Charles Island; and the same is true of Duncan. We have been all over the island, and not a single specimen was seen. On all the other islands *Nesomimus* was exceedingly common. It is highly interesting to see that *Tropidurus* is greatly reduced on Charles Island. During my whole stay there I saw two specimens, of which I was fortunate enough to secure one. I do not need to state that I took the greatest pains to find more. On Duncan only twelve specimens could be secured after long hunting. On all the other islands *Tropidurus* is exceedingly frequent. Exactly the same we find in such genera which are represented by different species on one island.

One or two, perhaps three, of the "three original species" may be extinct. This condition can only be explained by the subsidence theory, which, as I have stated in my article published in your journal, also gives the only satisfactory explanation of the harmonious distribution and differentiation of fauna and flora.

My opinion is that at the time when these islands were still in connection there existed already a great number of species of certain genera. As soon as separation begun each of these species was differentiated for itself, just in the same way as if it were a genus. It might happen that one or more, even all, of the species of such a genus became extinct on certain islands, or were not present there during the time of separation.¹

Let us suppose the number of the species of *Geospiza* was four in the time when these islands were still in connection. These four species may be called *a*, *b*, *c*, *d*, and may be represented by *G. fuliginosa*, *G. fortis*, *G. strenua*, and *G. dentirostris*, which latter species I have not yet seen. *a*, *b*, *c*, *d* is dependent on the different conditions on the different islands; taking three islands with the conditions *x*, *y*, *z*, we can express the species on these three different islands, which formerly were all in connection, in this way:

$$\text{1st island, } a \times f(x) - b \times f(x) - c \times f(x) - d \times f(x)$$

$$\text{2d island, } a \times f(y) - b \times f(y) - c \times f(y) - d \times f(y)$$

$$\text{3d island, } a \times f(z) - b \times f(z) - c \times f(z) - d \times f(z)$$

The greater the difference between *x*, *y*, *z*, the greater the time of separation, which may be expressed by *f*(*x*), the greater will be the

¹ I may state here the fact that North Chatham, which is separated from the principal portion by barren lava fields, does not contain a single species of *Camarhynchus*, nor *Nesomimus*, nor *Certhidea*.

difference of the species. If one or the other of the species dies out, we can have, for instance :

$$\begin{array}{lclclcl} \text{1st island, } a \times f(x) & - & o & - & c \times f(x) & - & d \times f(x) \\ \text{2d island, } & o & - & b \times f(x) & - & o & - & d \times f(x) \\ \text{3d island, } & o & - & o & - & c + f(x) & - & o \end{array}$$

This, I think, will be sufficient to express my opinion on the differentiation of such genera which contain more than one species.

Now some words about the birds themselves. *Creagrus*, of which, so far as I know, only four specimens exist in the museums, has been considered a very rare bird ; all the authentic specimens of which have been collected at Dalrymple Rock, west of Chatham. This bird is quite common here. We have seen it near Freshwater Bay, Chatham, between Charles and Hood, and found it in considerable numbers on the rocks in Gardner Bay, and on Gardner Island, near Hood, in hundreds of specimens ; it was seen on Brattle, where many specimens were collected ; it was also found on a rock north of Sullivan Bay, James, and on the Seymour Islands, north of Indefatigable. *Creagrus* is probably found on every steep rock which contains holes, in which the bird breeds.

On Albemarle, from which island only a few species of birds were known, we found over forty species (South Albemarle), a number greater than ever recorded from any island. *Geospiza magnirostris*, not observed since Darwin, was found on South Albemarle and Jervis ; it is simply the representative of *G. strenua* of other islands, as *G. conirostris* is the representative of this form on Hood.

I will conclude this letter with a few words about the reptiles. Of *Tropidurus* I have already spoken. Geckos were found in great numbers on Charles (one species, *G. galapagoënsis*), on Albemarle, and on Chatham. Snakes I observed on Hood (one specimen collected), Barrington, and Albemarle. *Conolophus* exists in great numbers on Barrington and the Seymour Islands, but was not noticed on any of the others. *Amblyrhynchus* is found on all islands, but is rare on some ; on Charles only two specimens were seen.

The land tortoises are extinct on Charles, Chatham, Barrington, and Jervis, on which islands they formerly existed. They are probably extinct on Hood, on which a thorough search of two days over the whole island was without result. They are said to still exist in reduced numbers on James (an examination of two days was without result) and on Indefatigable. On South Albemarle, where we remained twenty days, we found the land tortoises still in considerable numbers, but it is

exceedingly difficult to reach the places where they live. We secured eight living ones, of different size : five with shells one meter or more in length, and one, probably the largest one ever taken from the islands, with the carapace one meter and forty centimeters in length. You may imagine the amount of work when I tell you that these specimens had to be carried from eight to twenty miles over the lava fields and through the densest brushwood.

I do not need to say that there was no possibility of bringing the large tortoises down alive. The largest one must have had a weight of 400 pounds. On Duncan we secured eight tortoises; they are much smaller than the forms from South Albemarle, and resemble the Abingdon specimens. On the northeast side of Albemarle I tried to penetrate to the interior, but had to return after two days on account of the nearly impassable lava fields.

So far I can say that the expedition has had the greatest success, and I am convinced that my expressed opinion on the origin of this group of islands is the correct one. I may add that in a single instance (near Barrington) I have found a land bird flying over the ocean; it was the common *Dendroica aureola*, found on all islands. It is certain, therefore, that these birds do not travel from one island to the other, as is also fully sustained by the collections.

The birds are still as tame as formerly, especially on such islands which are not often visited. On Duncan a *Buteo galapagoënsis* sat down on a bush next to me. I touched him with a stick; he did not move. I began to tickle him on the head; this he seemed to like; and an hour later, when I had gone to a smaller island near that place, he also came over and sat down next to me to be tickled by the stick. *Myiarchus* is the tamest bird, and often sat down on my hat or my stick when I kept quiet.

I finish this letter, hoping that the expedition will be followed by others of the same nature. Biology is of the greatest importance for dynamical geology, and is in many cases the only source of information. The Fiji or Friendly Islands, which are considered as oceanic islands, but which I believe to be continental, ought to be examined, and also a group of islands which is doubtless of oceanic origin. Harmony or disharmony in the distribution of flora and fauna will always, I think, solve the problem of the origin. That variation goes on in definite lines, determined by the nature of the conditions, I am fully convinced. The theory of natural selection, especially the view of the "Neo-Darwinians," has not received any support; but more about this question later.

I left Chatham on September 1st for Tower Island. This island was very interesting, having never been visited before. *Creagrus* was found there in great numbers, breeding, besides *Fregetta*, *Sula*, and *Phaethon*. Of *Fregetta* a considerable number of embryos and nestlings were procured. Of land birds the following species were found: *Geopiza*, two species; *Cactornis*, one species; *Nesomimus*, one species; *Certhidea*, one species; *Dendroeca*, one species; the dove and owl were also observed. Not a single specimen of *Tropidurus* was seen; *Ambyrhynchus* is frequent, but small.

From Tower we went to Bindloe. All the birds collected by Dr. Habel were also obtained. *Tropidurus* is very common, and quite distinct from the Abingdon form. *Nesomimus*, which had not been recorded before from this island, is a very abundant bird.

On Abingdon we remained only a very short time. Nothing new is to be added to the results of Dr. Habel and the "Albatross."

We reached Guayaquil September 16th, and sailed to Panama on the 19th on the "Santiago."—G. BAUR, *Clark University*.

GEOLOGY AND PALEONTOLOGY.

The Desert Sandstone of Australia.—A paper by Mr. Charles Chewings, published in the Proceedings of the Royal Geographical Society, June, 1891, contains the following interesting account of the "desert sandstone" of Central Australia:

"At what period or periods the Lake Eyre depression was formed has not yet been satisfactorily decided; but we may fairly conjecture that an opening at one time existed to the south into Spencer's Gulf. During Cretaceous times, however, that and all other outlets were things of the past, and the detritus from the Macdonnell and James ranges, as well as many other high lands, was washed into this large basin, of which, so far as ascertained at present, the outline extends from the Coast range, situated a little south of the Gulf of Carpentaria, westward nearly to the overland telegraph line. It then runs north-east towards Lake Eyre, and, skirting the Macdonnell ranges elevation, curves round to the north of the Charlotte Waters telegraph station, in about the latitude of Lake Amadeus, which lake it approaches, if not includes. This is probably the western boundary of this system.

"From Lake Amadeus the Lake Eyre system extends northeasterly towards Port Augusta, takes a curve to the eastward, and runs along

east and west a few miles to the south of Lake Eyre. It then makes southeasterly for Barrier, and taking a long sweep to the east and north embraces the extent of those rivers that flow from south of the Gulf of Carpentaria into Lake Eyre. The shape is semicircular, and crescent-shaped, extending towards a half moon. No doubt detritus from the extensive area covered by the already-mentioned red sandstone formation contributed largely towards filling it up to a level much higher than the present level of the country; this is easily seen by the numerous tent-hills and table-lands scattered throughout the area of the basin, ranging from 200 to 500 feet high, of which Chamber's pillar is a remnant. As the basin sank, or surrounding land became elevated, so the flood waters carried this newer Cretaceous formation to the lowest depression, cutting deep gullies and wide waterways through the newer deposits, and generally lowering the basin. This has been going on probably from time immemorial; certainly from Cretaceous (secondary) age, down through Tertiary and Quaternary ages to the present time. When the seas that washed the softer and newer deposits away from the Macdonnell ranges and laid bare much of the primary rocks had subsided, and Central Australia was elevated quite above sea-level, and long ages of scorching summers had evaporated its larger lakes and surface waters, and the Cretaceous age (during which Lake Eyre was an inland sea) was rapidly becoming a thing of the past, a newer influence, and one that exists to-day,—viz., that of the wind,—probably blew into all secluded and rock-bound spots, depressions, shallow lakes, and like places the sandy weatherings from around their base, and a newer formation was the result. This is the commonly called 'desert sandstone,' for what reason I have never had a satisfactory explanation. Both as a shallow-water deposit and a dry wind-blown deposit it retains its unmistakable characteristics. Its color is that of an ordinary grindstone, and it consists of horizontal layers, the cap of each being harder than that underneath it. By weathering its sides get hollowed out, and in the caves thus formed the aborigines find a refuge from the extremes of weather, often painting devices on the walls.

"The great extremes of heat and cold, a dry atmosphere, and strong winds caused through radiation, tend to constant degradation of the rocks, the detritus being blown into sand-hills and distributed throughout this large area. In Western Australia, along the line of route taken by the Hon. John Forrest, surveyor-general of Western Australia, in lat. 26° S., a sandstone is met with that covers all other rocks from E. long. 122° to E. long. $126^{\circ} 30'$. In this extensive area of 'desert sandstone' all the rising ground is composed of it. 'Very often one

side of the rise forms a cliff.' Further to the north the late Colonel Warburton found this same sandstone formation taxed his camels to the utmost. In the eastern colonies a desert sandstone exists, but whether similar to that in Western Australia, I cannot say. Mr. Woodward has satisfied himself that this formation overlies most, if not the whole of the western coast formations from Cambridge Gulf to King's Sound, and that it extends far inland towards Central Australia.

"Under this sandstone formation the Carboniferous series he describes as well developed, and if it continues right across the continent, as it does in China, coal deposits may yet be found in the interior of Australia. He has also discovered a large lava flow in the northwest, and fixes the Leopold range as of Carboniferous age; also that the coast of Western Australia is rapidly rising, and he describes the sandstone area as extending inland 'as a vast table-land of from 1,000 to 2,000 feet above sea-level. No volcanoes exist in the colony of Western Australia, and the general appearance of the country throughout indicates a condition of remarkable quiescence, continuing even further back than the Carboniferous epoch.' He describes the rivers, for the most part, as 'simply immense storm-water channels. Several large rivers have their sources in the western edge of this plateau, and cutting deep gorges through their upper horizontally bedded rocks, expose the underlying crystalline rocks across the strike of which they have cut their channels,' and considers that 'precious stones may be found in the amygdaloid regions. The mineral-bearing districts have been greatly decomposed and altered by thermal waters and steam at the time of the deposition of the lodes, and later by the heat evolved by the oxidation of the metallic sulphides.' He corroborates the opinion that the uppermost or desert sandstone is of terrestrial origin, and probably formed shortly after the elevation of this continent. In places these beds are of terrestrial origin, there is not the slightest doubt; in other places the indications point to a swampy or lacustrine source."

Structure of the Piedmont Plateau.—Prof. Williams, of Johns Hopkins University, offers the following hypothesis as to the structure of the Piedmont region in Maryland:

"That the eastern area is composed of rocks far more ancient than the western, which extend out under these, forming the floor upon which they were deposited; and that although already much folded and metamorphosed, this crystalline floor underwent at least one more folding after the schists had been laid down, carrying these with it and

involving them in a considerable but not an extreme amount of disturbance and metamorphism."

The hypothesis seems to account for the difference between the rocks of the two areas and for the abruptness of their contact, while at the same time it explains the conformity along this contact, and the fact that this boundary and the axes of the synclinals are not coincident. (Bull. Geol. Soc. Am., Vol. II., pp. 301-322, pl. 12.)

The Triassic of Massachusetts.—Mr. Benjamin Emerson does not accept the theory that the Triassic deposits of Massachusetts are, as a whole or in part, of glacial origin, but that they result from currents. This will explain the sudden and irregular transitions from coarsest to finest sediments, and the derivation of many of the coarse beds from rocks not known in place among the crystallines of the surrounding region. He believes the region to have been a narrow bay, with tides that swept up the eastern and down the western side, and left the center of broad, shallow mud-flats at a considerably higher level than the shoreward portion, so that they alone were regularly abandoned by the water at low tide. It follows from this that the deposits were contemporaneous, and this is shown by the position of the trap sheets. (Bull. Geol. Soc. Am., Vol. II., pp. 451-456, pl. 17.)

The Relations of the Traps of the Newark System in New Jersey.—Mr. N. H. Darton makes known the following facts:

"The trap outcrops inclosed by the Watchung Mountains of North-eastern New Jersey, and the outlying mass near New Germantown, are lavas, contemporaneous with the inclosing sediments, while all the other traps described are intruded sheets and dikes.

"The igneous rocks are basalts, the eruptives are fine-grained and generally somewhat glassy, and the intrusives are coarser-grained, generally being dolerite, in some cases including considerable biotite and often near gabbro in structure.

"The great hooks characterizing the southernmost outcrops of the Watchung traps are mainly due to flexure, and the bowed course of their northern terminations and of Towakhow Mountain are due to the same cause." (Bull. U. S. Geol. Surv., No. 67.)

The Iron Ore District of East Texas.—The second annual report, 1890, of the Geological Survey of Texas contains an interesting account of the iron ore district of East Texas, by Mr. E. T. Dumble. The territory described lies east of the 96th degree of longitude and north of the 31st parallel of latitude. From this area is

excluded, as being non-iron-bearing, the portion north of Sulphur Fork, and also the northwestern corner, in which the black waxy prairies of the Cretaceous are the prevailing formation.

In this district, so restricted, there are nineteen counties, containing in the aggregate 14,430 square miles. In each of these counties iron ore exists in greater or less quantities and of varying qualities.

The region is underlaid for the most part by strata of Cenozoic age. In only a few places are there exposures of Cretaceous strata, and when they do appear as inliers they belong to its uppermost members and are accompanied by salines.

Meniscotheriidae and Chalicotherioidea.—The Meniscotheriid family of Condylarthra, which has been found only in the American Wasatch, and is represented by a single genus, has always been placed in a very doubtful phylogenetic position. Dr. Wortman in 1886¹ was inclined to "regard Meniscotherium as the direct ancestor of the Hyracoidea, notwithstanding their wide separation in time and space." Schlosser in the same year² recognized the striking likeness of the molars of Meniscotherium to those of Chalicotherium, which was at the time believed to be a true perissodactyl, so that he naturally did not trace any ancestral relationship between these forms. He considered Meniscotherium (*op. cit.*, p. 120), with Macrauchenia, to be Perissodactyla which had retained a very primitive foot structure. Since this paper was published Chalicotherium has been removed to a separate division of Mammalia, affiliated to the Perissodactyla, but representing a distinct line.

I find there are many striking resemblances between the dentition of Meniscotherium and Chalicotherium, and it appears to me probable that the Wasatch genus is related to the ancestral forms of Chalicotherium. The resemblances consist (a) In the enlargement of the posterior half of the dental series, and reduction of the anterior half. (b) The upper molars are of precisely the same pattern; the protocone is isolated; the hypocone and metaconule are united in a short transverse crest. (c) The similarity in the lower molars is seen especially in the reduplication of the metaconid in both forms, and the absence of the third lobe upon the last lower molar.

The differences between these genera are such as separate many higher from lower types, in the displacement of the foot bones and

¹"Comparative Anatomy of the Teeth of the Vertebrata," p. 476.

²"Beit. z. Kennt. Niss der Stammes-geschichte d. Hufthiere," *Morph. Jahrb.*, Band 12, p. 21.

evolution of the teeth. Chalicotherium shows a diplarthrous condition of both carpus and tarsus and no fibulo-calcaneal facet; there is no third trochanter; the anterior intermediate cusps of the upper molars (protoconule) is reduced.

We shall remain in the dark as to the truth of this suggestion until we find the complete feet of Meniscotherium. In the meantime the striking resemblances seen in the teeth point strongly towards a distant relationship between these forms.—HENRY F. OSBORN, *American Museum of Natural History, New York, August 27th, 1891.*

The Family of Astrapotheriidae.—Senor Alcides Mercerat has recently published a paper on the Astrapotheriidae, to which he refers two new genera, Listriotherium and Xylotherium, as well as Burmeister's genus, Astrapotherium. Listriotherium is represented by two new species: *L. patagonicum* Merc., from the Eocene of Monte Leon, and *L. filholii* Merc., from the Eocene of Santa Cruz. Xylotherium has but one representative, *X. mirabile* Merc., also from the Eocene of Santa Cruz. To Astrapotherium belong *A. patagonicum* Burm., *A. augustidens* Merc. sp. nov., *A. marshii* Merc. sp. nov., *A. gaudryi* Merc. sp. nov., all from the Eocene of Mt. Leon, Patagonia; also *A. magnum* Owen, *A. burmeisterii* Merc. sp. nov., *A. robustum* Merc. sp. nov., from Santa Cruz, Patagonia, and *A. voghtii* Merc. sp. nov., from the Eocene of Chubut. (Extr. Rev. Mus. de la Plata, Tomo I.)

On a Skull of the *Equus excelsus* Leidy, from the *Equus* Bed of Texas.—I have received from my valued correspondent, William Taylor, a skull of the *Equus excelsus*, which is of much interest as the first that has come to light in the United States. It lacks only the posterior and inferior walls of the brain-case, and the premaxillary region was detached in such a way that its length is not absolutely certain, though contact of the adherent matrix was found. This skull shows that the *Equus excelsus* is intermediate in characters between the horse and the quagga and allied species, and possesses some Hippidium characters in addition. The resemblance is, however, greater to the quagga. This is shown by the shortness of the premaxillary region, the abbreviation of the maxillary posterior to the last molar, and the long excavation of the posterior nares, which extends to the line of the anterior border of the penultimate superior molar. It differs from both of these species in the posterior prolongation of the vomer over the presphenoid, and in the small size of the last superior molar. The latter tooth is smaller than

the penultimate, as in the species of *Hippidium* and the three-toed horses. The glenoid surface of the squamosal is of nearly uniform width, as in the *Hippidiums*, and not expanded at the external extremity, as in the horse and quagga. The *E. excelsus* differs from the quagga in the very slight decurvature of the symphyseal portion of the premaxillary bone. It approaches nearer the horse, but is even flatter. The incisor teeth do not exhibit the anterior longitudinal grooves of the crown seen in the two recent species mentioned. The patterns of the crowns of the superior molars are much like those of the two species named, but the internal inflections of the anterior and posterior borders of the external lakes are not so deep as in one or both of those of the *E. quagga* and *E. caballus*. The size of the skull is about that of the quagga.

The skull is that of an adult female. The frontal bone is crushed in between the orbits so as to crush the descending anterior plates of the former behind the nasal cavity. The free orbital borders and the parietal bones are not crushed. It is singular that that part of the arch of the skull which presents the strongest resistance to pressure is crushed, while the weaker regions remain entire. Unless a stone occupied the exact position calculated to produce this result, it might be imagined that this horse was knocked in the head with a stone hammer, such as has been found in the same bed by Mr. Taylor.—
E. D. COPE.

The Glacial Deposits at Hendon, England.—In a paper read before the London Geological Society, May 27th, 1891, Mr. Henry Hicks showed that glacial deposits had been spread out to a much wider extent over the Hendon plateau than had hitherto been supposed. There is evidence to show that these deposits have extended in a south and southwest direction across the Brent and Silk valleys, and now occur on most of the heights in the parishes of Kingsbury and Willesden. As the sands, gravels, and boulder clay which cover the Hendon plateau are found to rest on an undulating floor of London clay, the author considers it clear that the main physical features of this portion of Northwestern Middlesex were moulded at a very early stage in the Glacial period, and before the so-called middle sands and gravels and overlying upper boulder clay were deposited. At this time there could have been no barrier of any importance to prevent these deposits from extending into the Thames valley, and the evidence clearly points to the conclusion that the implement-bearing deposits on the higher horizons in the Thames valley should be

classed as of contemporaneous age with the undoubted glacial deposits at Hendon, Finchley, and on the slopes of the Brent valley. Mr. Hicks is therefore satisfied that man lived in the neighborhood of the Thames valley in the early part of the Glacial period, probably in pre-Glacial times. (*Geol. Mag.*, July, 1891.)

BOTANY.

Botany at the Washington Meetings.—From the 12th until the 29th of August there were almost constant sessions of scientific men in Washington at which botanical papers were presented. In the first place, the Association of the American Agricultural Colleges and Experiment Stations held a four days' convention, and during the opening session there was a report from the chairman of the botanical section of the work done at the various stations by the botanists thus employed. It was evident from this report that while systematic botany, making of collections, and the field study of various plants were important features, the main one in several states is the study of the fungous enemies of cultivated crops. In the meetings of the section of botany much time was spent in a consideration of the question of an exhibition to be made by the stations at Chicago in 1893. The work in botany will be divided, and those workers best able to exhibit fungi of the cereals will have them in charge, while others take the fruits, etc. Professor Tracy, of Mississippi, is chairman of the Botanical Committee of the Columbian Exhibition.

Professor Atkinson presented a paper upon the cotton fungi, and exhibited several oil paintings of diseased leaves showing the rust, blight "frenching," etc. The question of the importance of common names for fungi came up, and was discussed, with the conclusion that finely illustrated bulletins are the best way to overcome the difficulty. Professor Alwood presented two papers, one upon an apple-leaf blight which is very destructive in Virginia, and the results of his successful crossing of wheats. Many specimens of the latter were shown, and a lengthy discussion followed. A bacterial disease of the cabbage was reported upon by Professor Garman, while Professor Crandall exhibited a quantity of Rocky Mountain June berries, and spoke of them as one of the coming fruits for Colorado. Professor Brewer exhibited some hybrid butternuts, and Professor Halsted presented a paper upon the germination of spores of species of fungi.

During the sessions of the College and Station Association, Mr. R. Worthington, F.C.S., of Rothamsted, England, delivered six lectures,

a large portion of which was made up of botanical matter. The microbes, for example, that take an active part in the nitrification of the soil were shown, enlarged by lantern projection upon a screen, as also were some other forms of bacteria of great interest to agriculture.

During the two days of the meetings of the Society for the Promotion of Agricultural Science there were many botanical papers. Thus Professor Arthur presented the results of field experiments under the title of "A Physiological Basis for the Comparison of Potato Production." Many practical points were developed. Professor Beal considered the description of varieties of strawberries and raspberries. Additional information was presented by Professor Burrell upon the bacterial disease of potatoes that is now quite widespread throughout the country. Professor Forbes treated of a bacterial disease of the chinch bug, while Professor Kedzie still further considered bacteria in his paper upon soil extract in relation to development of tubercles on clover roots. Injurious fungi received attention at the hands of Professor Galloway, who gave results of some experiments made the present year in the treatment of plant diseases, while Professor Halsted outlined conclusions from soaking seed beans to check anthracnose. Professor Green considered arsenic and copper as a fungicide and insecticide, and also gave the results of a treatment of raspberry anthracnose with fungicides. Professor Taft reviewed his work with fungicides for apple scab, and Professor Pammel considered some of the conditions which modify the appearance of parasitic fungi in plants.

The opening day of the American Association for the Advancement of Science had its full share of botany. President Coulter, as chairman of the section of biology, gave an address upon the future of systematic botany, and in the evening Dr. Goodale, as retiring president, unfolded the possibilities of economic botany. These excellent addresses the reader will peruse with much profit as presented in the scientific journals.

On Thursday, at the first meeting of the Botanical Club, Professor Arthur explained the working of some apparatus to be used in physiological botany; Professor Halsted spoke of a fungous disease of the egg-plant; Professor Atkinson showed the connection between a cercospora and sphærella; while Professor Pammel considered some conditions favoring the growth of fungi. In the discussion the importance of making yearly notes of important species was mentioned. Professor Fernow spoke of the value of a national arboretum, and resolutions were offered favoring it. In Section F Professor Atkinson presented a paper upon the structure and dimorphism of *Hypocrea tuberiformis*. Professor MacFarland, of Edinburgh, added another chapter in the history of the Venus fly-trap;

specimens illustrating the peculiar quality of irritability possessed by these plants were shown and the subject discussed. Professor Campbell gave a paper on the prothallium and embryo of *Osmunda claytoniana* and *O. cinnamomea*, fully illustrated by blackboard drawings. A new nectria found upon the sweet potato and associated with the stem rot was treated of by Professor Halsted. The Compositæ collected by Dr. Palmer in Colima, and the flora of Carmen Islands, were two papers by Professor Rose. Professor T. Smith illustrated fully the uses of the fermentation tubes in bacteriology by a score of specimens, many containing important disease germs.

On Friday, during the morning hour for the Botanical Club, papers were presented by Professor Fairchild on a new currant disease, by Professor Riley upon Mexican jumping beans, by Professor Rose upon two new weeds, while one of the most enjoyable features was the presentation to the members of the club of a souvenir by the Washington Botanical Club, consisting of twenty-two photographs of Washington points of interest, neatly bound. In the biological section notes upon bacteria of Cucurbits by Professor Halsted were followed by the four papers of the physiological series prepared by appointment, as follows: "Transportation or Loss of Water in Plants," by Professors Bessey and Woods; "Movements of Fluids in Plants," by Professor Beal; "Absorption of Fluids by Plants," by Professor Pammel; and "Gases in Plants," by Professor Arthur. After some discussion, and particularly as to the absorption of carbonic gas in soil water by roots, the botanical papers for the day in the section closed with notes upon an anthracnose by Professor Halsted. The botany for the day, however, was continued far into the evening by Professor John M. MacFarland, who gave a public lecture upon heredity in plants, by which it was shown with a series of three simultaneous lantern projections that the differences in the parents were blended in the offspring even to the size of cells, ducts, thickness of bark, and many other microscopic details.

On Saturday, at the Botanical Club, the first paper was read by Miss Southworth, on some strange fungi. Dr. Mohr gave a contribution upon some phanerogams of Alabama. A novel method of caring for *Myxomycetes* was explained by Professor Cook, and Mrs. Claypole gave a paper upon an onion disease. In Section F Professor Riley treated of microorganisms as insecticides, followed by further observations on a bacterial disease of oats by Professor Galloway. Dr. Vasey outlined the botanical field work of his division, while Professor Waite presented results from recent investigations of pear blight. The spectroscope in bacterial studies, by Professor Brashear, closed the long list of botanical papers presented at Washington.—BYRON D. HALSTED.

EMBRYOLOGY.¹

Studies in Cephalopods.²—Dr. S. Watase, of Clark University, publishes under the above title No. 1 of his contributions on the cleavage of the ovum. The opening paragraph indicates the contents of the paper. "In the following pages I will first attempt to treat the general morphology of the animal ovum from the standpoint of some embryological and morphological facts and theories. In the next place, the relation of the external phenomena of cleavage, as shown in the behavior of the cytoplasm, to the internal phenomena of nuclear or karyokinesis will be discussed. In this connection some theories on karyokinesis will be examined, my interpretation of the cleavage phenomena being that they are essentially the analysis of the potential tissues contained in the cleavage nucleus, and this karyokinesis is the method of such analysis and the achromatic spindle the instrument used in the analysis. The cleavage of the squid will then be described, and finally variations in the cleavage of the same animal will be discussed." It is impossible to here go into the theoretical discussions that occupy the larger part of the paper, but the following quotations, taken here and there, may serve to give some idea of the author's convictions. From a review of the literature the author concludes that "however diverse the examples, they all point to one and the same conclusion,—namely, that in the metazoan ovum and its derivations the tissue cells are more than a homogeneous, isotropic mass of protoplasm devoid of a definite symmetry. The study of the karyokinetic figure shows, Van Beneden points out, that the cell is not only uniaxial, but also bilateral. In several forms of ova, carefully studied, the axes of the karyokinetic figure correspond in a definite way with the recognizable axes of a given ovum, the external shape of which is chiefly determined by the quantity and distribution of the food yolk. The axes thus determined are maintained through the different stages of growth, and give rise to definite axes of the larvæ or of the adult organism. If these facts be more firmly established by the further investigation of the subject, we may say with Van Beneden 'that the old theory of *evolution* is not deprived of all foundation, as is generally believed to-day.'

In this connection a communication from Dr. C. Ishikawa is of great interest,—viz., that the summer and winter eggs of a "certain

¹ Edited by Dr. T. H. Morgan, Johns Hopkins University, Baltimore, Md.

² *Journal Morphology*, Vol. IV., No. 3.

form of Daphnidæ undergo different types of cleavage, one being holoblastic and the other meroblastic, the difference being probably produced by the amount of food yolk; the summer eggs belong to the regular holoblastic type of cleavage, and the winter egg to the meroblastic type, showing a close resemblance to the ova of some insects."

The author's view as to the mechanism of karyokinesis is explained. The conclusion is based largely on a study of karyokinesis in the squid and starfish, and the author believes this same explanation may apply to the whole phenomena of cell divisions, the essential point of the theory being that the "archoplasmic filament" radiates from two centers on opposite sides of the eggs penetrate the cell membrane, flattening the chromosomes into a plate, the radiating fibers (archoplasmic filaments), continuing to push, break up the plate into two portions, driving each in the opposite direction,—*i.e.*, away from the archoplasmic spheres. The bilaterality of the egg of the squid is the same as the bilaterality of the adult animal; and the arrangement of the protoplasmic cap at the animal pole also shows well-marked bilaterality, corresponding to that of adult animal.

The Regeneration of the Tail of Lumbriculus.³—Miss Randolph has an abstract of her work on the growth of new tails in the Annelids. The new ectoderm arises by proliferation of the ectoderm around the line of fission. From this new ectoderm arises the ventral nerve-chain and the dorsal setæ. The new digestive tract is formed from the cells of the old. The most interesting fact is in the formation of the new mesoderm, which "is formed in great part from specialized cells in the region of the peritoneal epithelium of the ventral longitudinal muscles, on each side of the ventral nerve-cord, between it and the ventral row of setæ. These cells, which I propose to call neoblasts, are distinguished from the cells of the peritoneum by their great size and by the presence of a cell body. They are to be found in every variety, with the possible exception of one or more at the anterior extremity, and represent the 'chorda cells' described by Semper in the Nais and Chætogaster. Very soon after the fission of the worm the neoblasts in the end somite begin to divide, and give rise to the greater part of the embryonic tissue that is afterwards differentiated into mesodermic structures.

"The neoblasts are to be regarded as specialized embryonic cells, set apart for the rapid formation of new mesodermic tissue immedi-

³ *Zool. Anz.*, No. 362, 1891.

ately upon the fission of the worm. They are present in great numbers in the Naids, where the formation of new tissue is much more rapid than in *Lumbriculus*, and also in *Tubifex*, in which regeneration is a very slow process."

Neuroblasts in the Arthropod Embryo.⁴—Mr. William M. Wheeler publishes a short paper on the discovery of neuroblasts or formative ganglion cells in Arthropods. "Carefully made transverse sections through either lateral chord are seen to consist, in early stages, of two kinds of ectoderm elements: smaller ones with rather deeply stainable elongate oval nuclei, and *four large* succulent cells with pale spherical nuclei. These four large cells, the neuroblasts, lie side by side just beneath the smaller ectoderm elements in a plane parallel to the surface of the yolk." The author believes the eight rows of the lateral chords to be homologous with the two rows of cells derived from the neuroteloblasts of Annelids, and "the fact that there are two rows in an Annelid, whereas there are eight in *Xiphidium*, can constitute on very serious obstacle to this homology." The neuroblasts have been seen in *Xiphidium*, *Melanoplus*, *Blatta*, and *Dolyphora*.

Morphological Notes from the Biological Laboratory of the Johns Hopkins University.—The anatomical and embryological work done in the morphological laboratory of Professor Brooks is published annually, in the form of complete papers and preliminary notes, in the *University Circular*.⁵

The May (1891) number contains the following embryological articles:

"On the Structure and Development of the Gonophores of a Certain Siphonophore Belonging to the Order *Auronectæ* Haeckel." By W. W. Brooks and E. G. Conklin.

"Preliminary Note on the Embryology of *Crepidula fornicata* and *Urosalpinx cinerea*." By E. G. Conklin.

"The Anatomy and Transformation of *Tornaria*: A Preliminary Note." By T. H. Morgan.

"Notes on the Habits and Larval Stages of the American Lobster." By F. H. Herrick, of Adelbert College.

"The Reproductive Organs and Early Stages of Development of the American Lobster." By F. H. Herrick, of Adelbert College.

"On the Early Stages of Echinoderms." By W. H. Brooks.

⁴*Journal Morphology*, Vol. IV., No. 3, 1891.

⁵Vol. X., No. 88, May, 1891.

Am. Nat.—October.—5.

"Contributions to the Embryology of *Asterias vulgaris*." By G. W. Field.

The first of these contributions treats of the structure and development of the Gonophores in *Rhodalia*, from the Pacific Ocean. Haeckel regarded the animal as so unlike all other Siphonophores as to necessitate its being placed in an entirely new order,—Auronectæ. Haeckel's description of the structure of the female (and male) gonophores is shown to be in all probability erroneous. The authors conclude: "The egg-pouch must be regarded as a part of the stem where the growth of the cells may take place while the gonophore is developing. As soon as the gonophore is formed, one of the eggs, already quite large, passes into it, where it lies between the ectoderm and endoderm of the mambrum. Then by the disintegration of the egg-cells remaining in the egg-pouch, and by the formation of large entodermal folds which have a secretory function, the egg is rapidly nourished, and grows to a very large size. The whole arrangement is to secure as rapid a development of the sexual cells as possible," as in the *Hydromedusæ*.

Mr. Conklin has studied the early stages in the development of *Crepidula* and *Urosalpinx*. Of the first four macromeres two meet in the center on a line which Rabl has called the "cross furrow"; the other two are acute towards the center, and do not meet each other. "By the position of the macromeres with regard to the 'cross furrow' the first and second cleavage furrows may easily be distinguished; *e.g.*, if the egg be viewed from the formative pole, and so that one of the cleavage furrows is in the line of vision, the macromere to the right of this furrow and farthest from the observer will be acute at its center if the furrow on the line of vision be the first cleavage furrow; it will be obtuse,—*i.e.*, will meet the opposite macromere in the cross furrow—if the furrow in the line of vision be the second cleavage furrow. Of course the reverse would hold if the egg were viewed from the vegetative pole. The examination of many hundred eggs has shown that the position of the macromeres in relation to the cross furrows and to the first cleavage planes is a constant one."

Urosalpinx differs from *Crepidula* in the fact that while the four macromeres of *Crepidula* are equal in size, the four macromeres of *Urosalpinx* are very unequal, one being much larger than the other three. "Two furrows appear simultaneously, and seem to divide the ovum into one large sphere and two smaller ones. Really, however, one of the smaller spheres is not completely separated from the larger one, and *soon after fuses with it*. This smaller sphere is merely a constricted portion of the larger sphere, and contains the nucleus. Thus

it is seen that of the two furrows mentioned but one is a true cleavage furrow, and it divides the egg into a larger and a smaller moiety. One of these protuberances is cut off to form a macromere equal in size with the two smaller ones; the other protuberance is a part of the larger macromere, and *again fuses* with it. There have thus been formed by two vertical furrows, comparable to the first and second cleavage furrows of *Crepidula*, three small and one large macromere."

A preliminary note is published by T. H. Morgan on the larva of *Balanoglossus*,—*Tornaria*. Reasons are given for regarding the common *Tornaria* of the New England coast as belonging to a different species from the *B. kovalevskii* of the same coast, so that the parent form is not at present known in connection with the larva. A description is given of the formation of the different organs as they appear in the life of the larva; for instance, the so-called heart (proboscis vesicle or gland) probably originates from a very few mesenchyme cells; the first pair of paired cavities arise as proliferations from two points in the walls of the stomach, and the second (last) pair of paired cavities arise as *solid* folds from the posterior division of the digestive tract (endodermal); the nerve-chord is formed by the collar rolling over the invaginating plate of ectoderm from the two sides, exactly as in *Amphioxus*. "The similarities of *Tornaria* to the Echinoderm larva are very numerous, and I cannot believe are due to superficial resemblances. If this be true, the antiquity of the larva must be very great, though *not necessarily ancestral*. The relationship of *Balanoglossus* to the vertebrates seems more than probable, as Bateson has pointed out."

The two papers by Prof. F. H. Herrick on the American lobster have been already reviewed in the July number of the *NATURALIST*.

Prof. Brooks has a short note on some interesting structures in the early stages of echinoderm larvæ. "Several observers have recorded the occurrence of a *right water pore* and pore canal, as well as those which occur normally on the *left* side, . . . but the former have heretofore been regarded as monstrosities. In the summer of 1889 I collected with a tow net, in the open waters of Wood's Holl, great numbers of normal, vigorous starfish larvæ; and upon studying their structure by serial sections I found that the water system is at first bilaterally symmetrical in every particular, although the right water pore and pore canal degenerate and disappear very early in the life of the larvæ, so that the older larvæ exhibit no traces of those structures. . . . The phenomenon in question has a direct bearing upon the significance of the ciliated, bilateral swimming larva of Echinoderms,

and it furnishes a strong argument in favor of the view that the larva is ancestral."

Mr. Field published a contribution to the Embryology of *Asterias*. In this form the mesenchyme formation precedes and is continued during the process of invagination, confirming the view of Metschnikoff and Korchelt as to the absence of two "urmesenchymezellen" in the Echinoderms. The author agrees with Semon's recent paper on the formation of the adoral band. At the apex of the preoral lobe there is an ectodermic thickening comparable with the apical plate of *Tornaria* and *Trochophore*. The formation of a right water pore is described in detail, confirming Prof. Brooks's discovery and reaching the same conclusion that "the state with two bilaterally symmetrical water pores is a definite stage in the ontogeny of *Asterias*, and that it has a phylogenetic significance." The view that the bilateral larval form of the Echinoderms is ancestral, and not secondarily acquired, is gaining ground," and the author believes that the bilateral water pores may be homologous with a pair of nephridia. The later history of the Enterocoels is described.

ENTOMOLOGY.¹

Entomology at Washington.—Three entomological societies met at Washington, in connection with the Association of Agricultural Colleges and Experiment Stations and the A. A. A. S., during the week of August 15th to 22d. These were the Section of Entomology of the Experiment Stations, the Association of Economic Entomologists, and the Entomological Club of the A. A. A. S. Besides these gatherings many papers upon entomological subjects were read before the Society for the Promotion of Agricultural Science and Section F of the A. A. A. S. Many entomologists were present at these meetings from various states, and the entomologists of Washington added greatly to the interest taken in these meetings.

SECTION OF ENTOMOLOGY OF EXPERIMENT STATIONS.—The opening session of this section was held on Saturday afternoon, August 15th, at the Columbian University, and consisted of a discussion of the proper duties of the entomologist of a station. Nearly all the members present held that so far as practicable but few subjects

¹ Conducted by Prof. C. M. Weed, Hanover, N. H.

should be investigated at a time, and that as soon as a subject had been thoroughly studied and the results and remedies published in a bulletin of the station, that particular investigation should be considered ended, unless future investigation brought to light some new points of importance. It was not considered the duty of a station entomologist to visit various parts of his state for the purpose of showing individual farmers how to handle insecticide machinery or how to destroy the locusts, after such a subject had been thoroughly explained in a station bulletin.

Many other subjects relating to station work were brought up and discussed. An election of officers resulted in the choice of Lawrence Bruner, of Nebraska, chairman, and F. M. Webster, of Ohio, secretary.

Monday evening Prof. A. J. Cook, of Michigan, read his report as chairman for the past year, before the Association of Agricultural Colleges and Experiment Stations. The report consisted of a résumé of the work done at the stations during the year, and that which is now in progress. Owing to the early date at which a report was called for, many of the stations had not reported; but from the reports obtained it is seen that the present season has been a most active one on the part of the station workers in entomology. The results obtained at the different stations were given, and the equipments of the stations were also described. In most of the stations the entomologist has some other department in charge, and in some cases teaches as well. The best combination shows itself when the entomologist has no other department of the station, but teaches entomology and perhaps zoology in the college connected with the station.

THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.—This association, while as yet very young, promises to become one of if not *the* foremost of its kind. Twenty-six working entomologists were present at the opening meeting on August 17th. Many new members were elected, some being corresponding members residing in foreign countries.

The opening address by Prof. James Fletcher, president of the association, was listened to with marked interest. Prof. Fletcher thought the entomologist should strive to popularize entomology as much as possible, in order that all might realize the importance of the subject from an economic standpoint as well as its possibilities, that all may see the beauties of the study of insects, even though "we don't eat them things."

Lawrence Bruner followed with an interesting paper upon "The Locust Appearances of 1891." Mr. Bruner had just returned from the western states, where the locusts are unusually abundant this year. It is feared that, unless prompt action is taken to destroy the eggs now being laid, many localities will be laid waste next year. Newspaper reports stated that railroad trains had been stopped by the locusts, and have implied that the locusts were so thick that the trains could not force their way through. The manner in which trains are stopped, however, has been by the crushing of a few hoppers upon the track, which so greased the rails as to stop the trains until sand was put upon the rails. In many of the localities infested local species have been found, although the migratory locust (*M. spretus*) was the most commonly distributed. Other species common are *M. brevitatus*, *M. atlantis*, and *D. longipennis*.

Mr. C. L. Marlatt read three short papers from C. H. Tyler Townsend, of New Mexico, upon some observations made in that region.

Prof. J. B. Smith followed with papers upon "Notes on Blackberry Borers and Gall Makers," and "The Melon Borer, *Melittia cucurbitæ*." Several points of interest were brought out.

Prof. Geo. F. Atkinson presented two papers: "A Cotton Cut-Worm," and "Note on a Nematode Leaf Disease." The case of the cut-worm upon the cotton was thought to be new.

Dr. D. S. Kellicott read a paper on "The Horn Fly in Ohio." He spoke of the appearance of this insect in Ohio and New York, and the probability as to the damage in the future.

Dr. C. V. Riley presented a paper on "Kerosene Combines with Pyrethrum." The origin and use of the so-called pyrethrum-kerosene emulsion was given. Many trials of this emulsion has proved it of but little value, and it does not merit the praise it has received.

Howard Evarts Weed followed with a paper on the "Work of the Season in Mississippi." The results of many experiments made during the season were given. *Hippodamia convergens* had been found feeding upon the cabbage, showing it to be an injurious insect. Screw worms (*Comptosomyia macellaria*) have been abundant in some parts of the state during the year. Cattle at the station are kept free from ticks by feeding sulphur and salt in equal parts by keeping it before the cattle *all* the time. Cotton-leaf worms (*Aletia*) and boll worms (*Heliothis*) have so far appeared in but small numbers this season.

The secretary read a letter from Miss Eleanor A. Ormerod, of England, giving the results of Paris green experiments in England. Miss

Ormerod is a corresponding member of the association, and by her work had done much to popularize entomology in England.

Dr. C. V. Riley then presented two papers: "*Dermestes vulpinus* in Tobacco," and "Government Work *vs.* the Patent Office." The first paper dealt with a case of serious damage to a large cargo of tobacco while in shipment. It was thought the *Dermestes* had gained access to the tobacco while in shipment, and that it was not in the tobacco at the time of packing. The second paper presented the difficulties undergone by the Department of Agriculture owing to that department not having a lawyer to represent it in the courts. The hydrocyanic acid gas treatment for scale insects in California originated with the department, but a man not connected with the department has recently received a patent on the mere technicality of using the treatment at night. In the discussion which followed it was the opinion of most of the members that the patent would not be valid if brought up in the courts.

Prof. E. A. Popenoe, of Kansas, gave an account of a recent outbreak of *Dissostira longipennis* in that state. The outbreak has covered an extensive area, and much damage has been done.

Mr. M. H. Beckwith, of Delaware, presented some interesting "Notes on a Corn Crambid." In some localities much injury has been done.

Prof. J. B. Smith next presented two papers, one on "A Note on the Habit of *Saperda candida*," and the other, "Notes of the Year in New Jersey." The latter consisted of an account of the principal insects which have caused injury in New Jersey the present year.

Mr. L. O. Howard presented an interesting paper on "A Note on Parasites." Several new genera and species were exhibited.

Prof. Herbert Osborn presented a joint paper by himself and Mr. H. A. Gossard on "Experiments with the Hopperdozer for Grass-Leaf Hoppers." The paper gave the results obtained with this machine in Iowa this season. The hopperdozer was said to be an excellent agent in the destruction of the leaf hoppers.

Another paper, on "The Clover-Seed Caterpillar," by the same authors as the above, was read by Prof. Osborn. This insect has been very numerous at Ames this year, and has proved very injurious.

A paper upon "Notes of the Season in South Dakota" was read by the secretary from Mr. J. M. Aldrich. Grasshoppers have appeared in large numbers in this state the present season, but by the constant use of hopperdozers many are killed, and fall plowing is practiced in order to kill the eggs.

Prof. Osborn gave the results of "An Experiment with Emulsions," in which it was thought the Hubbard formula was the best combination of soap, water, and kerosene.

At the meeting last year Mr. W. B. Alwood was appointed chairman of a committee to request the various force-pump manufacturers to use a standard fitting on spray machinery, in order that any nozzle will fit any pump. Entomologists and others who have had occasion to use spray machinery have had difficulty in using nozzles upon spray pumps other than the pumps made for the particular nozzle used. Mr. Alwood, in presenting his report, stated that most of the manufacturers had agreed to use a standard fitting for the spray nozzles manufactured by them. Correspondence with the manufacturers will be continued still further, and a printed report will soon be made, giving the arrangements made by the committee and the names of the manufacturers who have given their consent to the arrangements made by the committee.

The meetings of the association were held at the Columbian University the two days preceding the meeting of the A. A. A. S. The committee on nominations of officers presented its report as follows, which was adopted :

President, Dr. J. A. Lintner, of New York ; first vice president, Dr S. A. Forbes, of Illinois ; second vice president, Prof. J. H. Comstock, of New York ; secretary, F. M. Webster, of Ohio.

Prof. Cook gave some interesting notes upon some parasites, and Mr. Wallace presented a paper upon silk culture. At the conclusion the association adjourned to meet next year on the Monday and Tuesday before the meeting of the A. A. A. S., and at the same place.

ENTOMOLOGICAL CLUB.—The Entomological Club of the A. A. A. S. held its meetings at the Columbian University, at Washington, August 19th to 22d. Many entomologists were present, and it was probably the largest meeting of entomologists ever held in this country. By an arrangement with the Association of Economic Entomologists papers relating to economic entomology were presented before this body, while those relating to life-histories and classification were presented before the club.

President's Address.—In his address as president of the club Herbert Osborn made several recommendations of much importance. One was the advisability of an international gathering of entomologists at the World's Columbian Exposition in Chicago in 1893. He also recommended that a manual of entomology be prepared.

The Encyrtinae with Branch Antennae.—Mr. L. O. Howard presented specimens and drawings of several species of this subfamily in which the antennae were variously branched.

Insect Life in the Hot Springs of Yellowstone National Park.—This consisted of a letter to Mr. Schwarz from Mr. H. G. Hubbard, who is now collecting at the Yellowstone Park. Mr. Hubbard complained of the scarcity of species in this region.

Preliminary Notes on the Insect Fauna of the Great Salt Lake, Utah.—Mr. Schwarz presented many interesting notes upon the insect fauna of this region, especially Coleoptera.

Occurrence of the Pear Midge, Diplosis pyrivora.—Dr. Lintner gave an account of the appearance of this insect in various parts of New York.

Notes on the Pear Tree Psylla, Psylla pyricola. These notes were presented by Dr. Lintner, who also exhibited specimens.

Eye-Spotted Bud Moth in Western N. Y. Some of Our Orgyias.—These two papers were presented by Dr. Lintner. The first treated of *Tmetocera ocellana* in western New York, habits, and damage caused by this insect.

Habits of Xyleborus dispar and Volucella fasciata.—Mr. J. B. Smith presented two papers upon these insects. *Xyleborus dispar* has been quite injurious this season in New Jersey, and samples of the borings of this insect were presented.

Upon the Classification of Lepidoptera.—Prof. Smith is preparing a new list of this order, which will be out soon. Many changes have been made in the arrangement of the list from that of previous lists, and the reason for these changes were given. Prof. Smith also presented two papers upon "Revision of the Genus Cucullia," and "Staining Insect Structures."

Preserving Larvæ for Class Use.—Prof. E. W. Claypole spoke of the various means for preserving larvæ for study and illustration in collection.

A Substitute for Cork.—In this paper Prof. Claypole recommended cross-sections of soft woods as a substitute for cork. It seemed to be the general opinion of the entomologists present, however, that substitutes for cork did not pay, as specimens are more apt to be broken.

Natural Habitat of the Screw-Worm.—Prof. H. E. Weed presented observations upon this insect, which leads to the belief that its natural habitat is in dead flesh and decaying vegetable matter, rather than live animals, as is generally supposed.

The following papers were also read: "Two Borers Destructive to Mountain Ash," by Dr. D. S. Kellicott; "Bibliography of Entomology," by Mr. B. P. Mann; "Notes on *Sphecius speciosus*," "Some Interesting Phylloxeræ," by C. V. Riley; "Longevity of *Ixodes* and *Trombidium*," by Miss M. E. Murfelt; "Modification of Habit in Paper Wasps," by Miss Murfelt, showing that these wasps sometimes use paper already made instead of making it from wood.

The committee on recommendation of the president's address reported that a manual of entomology should be prepared, and recommended that specialists in the different orders be invited to prepare such a manual. The committee was continued another year, with instructions to correspond with specialists in the different orders and publishers, to report at the next meeting of the club.

The following officers were elected for the ensuing year: President, E. A. Schwarz; secretary, F. M. Webster.

The following entomological papers were read before Section F of the A. A. A. S.: "Origin and Development of Parasitic Habit in Mallophaga and Pediculidæ," by Herbert Osborn; "The Origin and Development of Parasitism Among the Sarcoptidæ," by H. Garman; "On the Habits of the Proctotrypidæ," by Wm. H. Ashmead; "The Biology of the Chalcididæ," by L. O. Howard; "Parasitism in Coleoptera, in Diptera, in Braconidæ, and Ichneumonidæ," by C. V. Riley; "Microorganisms as Insecticides," by C. V. Riley; "Enemies of the Honey-Bee," by A. J. Cook; "Notes on the Homology of the Hemipterous Mouth," by John B. Smith; "Epipharynx and Hypopharynx of Odonata," by John B. Smith; "The Mouth of *Copris carolina*, and Notes on the Homology of the Mandible," by John B. Smith.

Before the Society for the Promotion of Agricultural Science the following papers were read: "Fighting the Rose Chafer," by A. J. Cook; "Bees and Fertilization," by A. J. Cook; "A Bacterial Disease of the Chinch Bug," by S. A. Forbes; "Northward Spread of a Tropical Injurious Insect," by L. O. Howard; "The Kerosene Emulsion and Its Increasing Usefulness," by C. V. Riley.—HOWARD EVARTS WEED, *Agricultural College, Mississippi*.

ARCHEOLOGY AND ETHNOLOGY.

Proceedings of the Section of Anthropology (H) of the American Association for the Advancement of Science.—

Washington, D. C., August 17-25, 1891.—The section held its first session in the Chemical Hall of the Columbian University on Wednesday, August 19th, at 2 P.M., Prof. Joseph Jastrow, of Madison, Wisconsin, vice president of the section, and Mr. W. H. Holmes, of Washington, D. C., secretary.

Vice president Jastrow's annual address was entitled "The Natural History of Analogy." He described the study of analogy in its bearings on various forms of culture, and went on to indicate that this form of argument is used only with great caution by societies of to-day. Analogy was, however, a very predominant method of argument amongst primitive people. The speaker defined analogy by speaking of instances of a further degree of resemblance from a given degree of resemblance. The various types of agreement differing slightly from the standard were also treated. In almost all savage customs and beliefs, the professor said, abundant instances of reasoning by analogy were to be found. In magical practices, in interpretations of omens and dreams, in medicinal practices, and social and tribal customs striking instances of analogous argument abounded. The Zulu who chews a bit of wood to soften the heart of the man he wants to buy an ox from; the fetish determining by whether a stick stands or falls whether a war shall be kept up or allowed to stop; the medicine man who performs incantations over some personal belonging of his victim or by the use of out-of-the-way drugs,—all these were instanced as the results of analogy or the feeling of analogy. Similar traits in children were described and illustrated. He said that an abundant field of illustration was found in the popular superstitions, folk lore, and customs that have survived from a lower to a higher culture. The modern dream book, household medicinal practices, charms, and, in the more elaborate system of details of astrology, the doctrine of sympathies, and kindred pseudo-sciences were the fields from which he took his illustrations. From this progressive scientific thought has reached its present place instead of the shifting position once occupied by the argument of analogy. "That which was serious reasoning to our forefathers," he said in conclusion, "now takes its place as a proper instrument for amusement and lies at the basis of a joke. This

offspring of our race is also connected by history with this earlier form, and, furthermore, close relation is traced between the bypaths of modern civilization and the outgrown forms of culture among which it originated."

The committee elected by the section were as follows: Fellow to the council, Rev. J. Owen Dorsey, Washington. Sectional committee, Prof. O. T. Mason, National Museum; Prof. Thomas Wilson, National Museum; Prof. George H. Perkins, University of Vermont. Member nominating committee, Prof. Thos. Wilson. Subcommittee on nominations, Prof. Paul Carus, editor *Monist*; Prof. C. P. Hart, Wyoming, Ohio; Mr. Walter Hough, National Museum.

The meetings for reading papers commenced Thursday morning, August 20th, at 10 A.M. Prof. W. H. Leaman delivered an address on "The Essentials of a Good Education, with a New Classification of Knowledge." Mr. Walter Hough gave a description of "The Custom of Kava-Drinking as Practiced by the Papuans and Polynesians," followed by Major J. W. Powell's exhibition of his new linguistic map of the Indians of North America.

This map is the *chef-d'œuvre* of the Bureau of Ethnology, and one in which Major Powell takes much pride. It represents many years of patient, careful labor of himself and some of his most valuable assistants. It has been presented before in rather an inchoate form to several scientific societies, but now it has been completed and will appear in the next volume of the reports of the Bureau of Ethnology. It attempts to represent the locality of the various Indian tribes of North America at the beginning of history. As the Atlantic coast was occupied by white men much earlier than the interior and the Pacific slope, so of course its representation on this map dates to an earlier time. Fifty-eight linguistic stocks or families are represented on the map, and these are divided into 264 dialects, representing as many different Indian tribes. The major said that over 1,000 Indian languages are spoken, which can be divided among seventy-five different stocks, and that while the number was large the tendency was not toward multiplication, but toward a unification or parent stock. He explained his system of segregation and aggregation, and said that this map represented our earliest knowledge of the locations of Indian tribes in North America as shown by their language. It might require correction in the future, according as our knowledge of them might increase. In conclusion he made some humorous remarks on Volapük as a universal language, and compared it to the most barbaric of barbaric tongues, and that it approached closely primitive Indian tongues

of North America. He showed that civilized languages had little or no inflection, while the more primitive a language the greater the extremes of inflection, which is the case with Volapük. "To go to Volapük for a modern language would be like taking up the old wooden plow in agriculture again."

Mr. E. P. Vining, of St. Louis, Mo., criticised the map, disputed some of the propositions, and declared our knowledge of the Indian language of early times to be too indefinite and uncertain to form a foundation for so extensive a scheme of localization.

Dr. Thomas Wilson presented a collection of fifty or more of gold ornaments from his department of prehistoric archeology in the National Museum, taken from prehistoric graves chiefly in the province of Antioquia, United States of Colombia, lately procured; also a series of prehistoric jade implements from Mexico and Central America. All of them were beautifully wrought, and many of them had been sawed into two or more parts, and holes drilled for suspension as for amulets. Dr. Wilson said these were one of the varieties of jade called jadeite, the component parts of which were silica 59.4, alumina 25.8, soda 15.3. He described other varieties of jade,—nephrite, which was silica, magnesia, lime; fibrolite, silica and alumina; pectolite, silica, lime, and soda; and said pectolite was local in Arizona and New Mexico, implements made of it in prehistoric times being found among the ruins of the cliff dwellers of those territories. Nephrite was local in Alaska and British Columbia, where the wrought implements were found belonging to both historic and prehistoric times. These jadeite implements were confined to Mexico and Central America, though none of the raw material had been found nearer than New Zealand and the Asiatic coast. On this, with some addition, he said Prof. Putnam had founded the theory of the migration of the Central American and Mexican aboriginal population from Asia. If the theory be true, he did not believe that it had been, as claimed, by way of Behring Strait, because throughout the length of the continent no trace of such a passage had been found. On the contrary, similar implements made of a different material coming from the Yukon and other rivers had been found for a thousand miles over this route between Behring Strait and Mexico. Prof. Morse called on Prof. Putnam (who had just come in), and he expanded his theory, which in turn was attacked by Major Powell, who prophesied that jadeite would yet be discovered in that country. Prof. Putnam replied when it was there would be time enough, etc.

Rev. J. Owen Dorsey read a paper, and described, with charts, some of the peculiarities and phonetic types of the Siouan language.

Mrs. Anita Newcomb McGee read a paper entitled "An Experiment in Human Stirpiculture."

"It is not generally known that a carefully planned and methodically conducted experiment in human stirpiculture, probably the most extensive and systematic of modern times and civilized people, was carried on during the years 1808 to 1879 in Central New York. The originator of the experiment was a zealous but logical enthusiast, the late John Humphrey Noyes; the purpose was the promotion of sanctity; the place and the means were the Oneida community.

"In early life Noyes founded the peculiar sect called perfectionists, which in 1848 gathered disciples to the number of eighty-seven at Oneida. Here the community of goods and also of person was practiced, a system of complex marriage in which the amative and propagative functions were separated having been established.

"Until 1868 the birth-rate in the community was carefully limited, but at this date, financial success being assured and the members having increased to 250, the experiment in stirpiculture was begun. Its object was the increase of sanity in succeeding generations in order that sin, disease, and finally death might be abolished. Physique, intellect, hereditary qualities, mutual attraction, etc., were secondarily considered.

"The first principle of this stirpiculture was continued in and in breeding with judicious mixture of foreign blood from time to time. Its second principle was the careful selection of individuals. From 1869 to 1880 sixty children were born in pursuit of this plan. Of these five died at birth from unforeseen causes depending on the mothers, and one child was acknowledged a failure physically. Otherwise the experiment was progressing admirably, the children being given the best of care, when an unexpected result caused the failure of all Noyes's plans. The spirit of monogamy, ruthlessly kept in check before, became so strong in consequence of the mating of one-quarter of the community for stirpicultural purposes that the complex marriage system was given up in 1879. The dissolution of the Oneida community by mutual consent followed a year later. Noyes, foreseeing the end, had retired from Oneida, and died in 1886.

"Of the stirpicultural children only one has since died. The others, now aged eleven to twenty-two years, are on the whole somewhat above the outside average in physique and intellect. The blood of the children came largely from farmers and mechanics, with a

strong infusion from the intellectual Noyes family. It is therefore noteworthy that of the oldest sixteen boys ten are in business as clerks, foremen, etc., one is a musician of repute, two are students of law and medicine, two at college, and only one following a manual occupation, being a mechanic. Of the oldest six girls, two are at college and one is a student of the kindergarten system."

Mrs. Zelia Nuttall's paper on "Relics of Ancient Mexican Civilization" was, in her absence, read by Prof. Putnam. It described many Mexican antiquities, and threw a great deal of light on the civilization of ancient Mexico. The paper was illustrated with a number of small reproductions of Aztec ornamental designs, and of a chief's shield sent to Italy by Cortez, the only thing of the kind known to anthropologists, which were collected by the distinguished lady. One of the drawings she presented represented four peculiarly horrible-looking Aztec gods.

Prof. Edward S. Morse, of Salem, read two very clever papers on the allied subjects of "Bow Stretchers" and "Prehistoric Bows." The first of these papers referred to the puzzling little bronze implements found associated with Roman antiquities. The professor exhibited one of them. They are usually a couple of inches long, with three spurs of varying size and shape on one side, the ends of the main portion of the implement being two rings large enough to allow a man's fingers to be thrust through. They have always been called bow stretchers on the supposition that prehistoric archers used them in drawing back the strings of their powerful bows; but Prof. Morse pointed out the fallacy of such a conclusion, and showed the impossibility of their being so used. What the little affairs were used for by prehistoric man is, and may always be, a conundrum to the world's anthropologists. Incidentally Prof. Morse described the way various nations held and drew the bow-string, and said that in China the archer of to-day shoots his arrow by hooking his thumb around it, his thumb being protected by a peculiar ring, just like an immeasurably ancient bronze ring that the professor had got from prehistoric graves that dated back to the bronze age of man. His second paper, on "Prehistoric Bows," showed the great simplicity and similarity of the prehistoric bows found in Peru, Egypt, the peat bogs of Denmark, Holland, the Swiss lake villages, and other places.

"The Nez Perce Country," written by Miss Alice Fletcher, was read by Mrs. Barnes. This paper was an explanation of a map of the Nez Perce country, drawn by a native of the tribe, and showing the location of seventy-eight villages, and giving the Nez Perce names of mountains

and streams. A summary of the dimensions and groups of these villages was given and an outline of the tribal organization, with a brief account of the mode of living in the village and some deductions concerning the relation of the environment to the development of the people. A short biographical sketch of the Indian who made this map was also given and his photograph shown.

Dr. Wilson told of his connection with the Nez Perce tribe of Indians in his endeavor to recover possession of the land now occupied by the Lapwai reservation for the benefit of the A. B. C. F. M. (foreign missions), who had sent the first missionaries to that country before it became the property of the United States, and who had by their possession materially aided in making it such. The title of the board to the 640 acres, one mile square, was, he said, as good as that of any person in Washington to the house in which he lived; but they had never been able to get possession.

Mr. Frank Leverett, of Madison, Wisconsin, described by means of maps and charts the "Relation of the Loveland, Ohio, Implement-Bearing Terrace to the Moraines of the Ice Sheet."

"The Utility of Physical Study of Child Life" was next presented by Mrs. Laura Osborne Talbott. If "the child of to-day is to become the man of to-morrow," is not the responsibility of the present generation great regarding the civilization of the coming century? No thoroughly philosophical study has taken up the subject of child life at a sufficiently early period; the school laws do not permit a child to enter the public school before the age of six years. This is the most important period of a child's life, as its acquired perceptions then are most numerous, its inherited tendencies become fixed, and the creative power of the brain is most easily awakened. From the time that consciousness begins to unfold there is begun a series of acts that might engage the attention of psychical experts whose duty it would be to watch every indication of development for good or for evil. No crude management is required for child life, but teachers of rarest gift, whose tact, discernment, and wisdom will best assist in bringing forth from the embryo the fully rounded and complete being. Comenius, Pestalozzi, and Froebel have, in their philanthropic labors, conferred great benefits upon mankind, yet deeper insight into the child's mind is demanded than has been afforded by them. The demand of the age is for more creative power, or for an intellectual force that may be able to harmonize the different elements of our civilization. All questions arising from the mixed conditions of our present civilization must eventually revert to the final question, How can we best develop all the

energies of the individual? According to Herbert Spencer, "the process in which life essentially consists is the continuous maintenance of an equilibrium between the organism and its environment." It is evident that this want of equipoise or correspondence between the inner and outer life of the individual causes great failures in life. For ages the human race has been a prey to every variety of crime, and nations have risen only to fall into degradation. The same fate is before us unless we give to each child its inalienable right to develop its whole nature to its highest power of development. What an uplifting to all civilization would take place in a few generations if a truly wise and philosophical training could be given to young children in order rightly to stimulate their mental and moral powers. There are families who for many years have given great attention to this important subject, but there has been no general movement toward this object. From an economical standpoint it might be wise to endeavor to uplift the masses in this manner, for the ancients teach us that one member cannot suffer injury without danger to the whole body.

The paper on the "Origin of the Name Chautauqua," by Albert S. Gatschet, stated at length the linguistic reasons why this name, which is worded on the Seneca-Iroquois language still spoken in Western New York, cannot signify anything else but "one has taken out fish there." It is pronounced by these Indians T'kan Tchatak Wan, and the old English and French documents vary enormously in their mode of writing it. It is probable that fish were taken out by the Indians from Lake Chautauqua to stock the brooks and ponds of the vicinity. The author proposes to change the orthography of Chautauqua into the more scientific Chatakwa.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

American Association for the Advancement of Science.—

The fortieth meeting of this body met in Washington, D. C., from August 19th to 25th, inclusive. The officers were: *President*, Albert B. Prescott, Ann Arbor, Mich. *Vice Presidents*, (A) Mathematics and Astronomy—E. W. Hyde, Cincinnati, Ohio; (B) Physics—F. E. Nipher, St. Louis, Mo.; (C) Chemistry—R. C. Kedzie, Agricultural College, Mich.; (D) Mechanical Science and Engineering—Thomas Gray, Terre Haute, Ind.; (E) Geology and Geography—J. J. Stevenson, New York; (F) Biology—J. M. Coulter, Bloomington, Ind.; (H) Anthropology—Joseph Jastrow, Madison, Wis.; (I) Economic Science and Statistics—Edmund J. James, Philadelphia, Pa. *Permanent Secretary*, F. W. Putnam, Cambridge (office, Salem), Mass. *General Secretary*, Harvey W. Wiley, Washington, D. C. *Secretary of the Council*, Amos W. Butler, Brookville, Ind. *Secretaries of the Sections*, (A) Mathematics and Astronomy—E. D. Preston, Washington, D. C.; (B) Physics—A. Macfarlane, Austin, Texas; (C) Chemistry—T. H. Norton, Cincinnati, Ohio; (D) Mechanical Science and Engineering—William Kent, New York, N. Y.; (E) Geology and Geography—W. J. McGee, Washington, D. C.; (F) Biology—A. J. Cook, Agricultural College, Mich.; (H) Anthropology—W. H. Holmes, Washington, D. C.; (I) Economic Science and Statistics—B. F. Fernow, Washington, D. C. *Treasurer*, William Lilly, Mauch Chunk, Pa.

WEDNESDAY, AUGUST 19TH.—In the afternoon the chairmen of the sections delivered their addresses. Prof. Stevenson, of Section E, spoke "On the Relations of the Chemung and Catskill on the Eastern Side of the Appalachian Basin." Prof. Coulter, of Section F, spoke "On the Future of Systematic Botany." The subject of the address of Prof. Jastrow, of Section H, was "The Natural History of Analogy." In the evening the retiring president, Prof. G. L. Goodale, delivered an address "On the Possibilities of Additions to our Cultivated and Useful Plants from New Sources."

The papers read in Sections E, F, and H were as follows:

THURSDAY, AUGUST 20TH.—*Section E.*—Source of Supply to Lateral and Medial Moraines, John T. Campbell. New Meteoric Iron from Arizona Containing Diamonds, A. E. Foote. Post-Glacial Anticlinal Ridges near Ripley and Caledonia, N. Y., G. K. Gilbert. Purposes of

Mountain-Building and Their Relationship to the Earth's Construction, Warren Upham. Notes on an Extinct Volcano at Montreal, Canada, Henry Lampard. On a New Horizon of Fossil Fishes, E. D. Cope. On the Cranial Characters of *Equus excelsus* Leidy, E. D. Cope. On Problematic Organisms and the Preservation of Algæ as Fossils, Joseph F. James. On the Age of the Mount Pleasant, Ohio, Beds, Joseph F. James. Preliminary Report of Observations at the Deep Well near Wheeling, W. Va., William Hallock. The Eureka Shale of Northern Arkansas, T. C. Hopkins.

Section F.—Notes on the Physiological and Structural Changes in Cayuga Lake Lampreys, Simon H. Gage. Notes on the Heart of Certain Mammals, Ida H. Hyde. The Transformation of the Vermilion-Spotted Newt, Simon H. Gage. On the Kinds of Motion of the Ultimate Units of Contractile Living Matter, John A. Ryder. On the Extinction of the Scapular and Pelvic Arches and Limbs of *Lacertilia*, E. D. Cope. On the Structure and Dimorphism of *Hypocrea tuberiformis*, Geo. F. Atkinson. Another Chapter in the History of the Venus Fly Trap, J. M. Macfarlane. On the Prothallium and Embryo of *Osmunda claytoniana* and *O. cinnamomea*, Douglas H. Campbell. A New Nectria, Byron D. Halsted. The Compositæ Collected by Dr. Edward Palmer in Colima, Joseph N. Rose. The Flora of Carmen Island, Joseph N. Rose. Uses of the Fermentation Tube in Bacteriology, with Demonstrations, Theobald Smith. The Foraminifera, with a New Device for the Exhibition of Specimens, James M. Flint.

Section H.—The Essentials of a Good Education, with a New Classification of Knowledge, Wm. H. Seaman. The Custom of Kava-Drinking as Practiced by the Paquans and Polynesians, Walter Hough. A Linguistic Map of North America, J. W. Powell. Jade Implements from Mexico and Central America, Thomas Wilson. Gold Ornaments in the United States National Museum from the United States of Colombia, Thomas Wilson. Siouan Onomatopoes Interjections and Phonetic Types, J. Owen Dorsey. On a Collection of Stone Pipes from Vermont, G. H. Perkins. The Importance and Methods of the Science of Comparative Religion, Merwin Marie Snell.

FRIDAY, 21ST.—*Section E.*—Fossil Tracks in the Triassic of York county, Pa., A. Wanner. New Footprints of the Connecticut Valley, M. N. Mitievier. The Plant-Bearing Deposits of the American Trias, Lester F. Ward. A Reply to Professor Marsh's Note on Mesozoic Mammalia, Henry F. Osborn. Principles and Methods of Geologic Correlation by Means of Fossil Plants, Lester F. Ward. Exhibition of

Certain Bones of *Megalonyx* Not Before Known, James M. Safford. On the Probable Existence of a Second Driftless Area in the Mississippi Basin, R. D. Salisbury. The Cincinnati Ice Dam, Frank Leverett. The Structure of the Ouachita Uplift of Arkansas, Leon S. Griswold. The Relations of the Archean and the Algonkian in the Northwest, C. R. Van Hise. Results of a Well-Boring at Rochester, N. Y., Herman L. Fairchild.

Section F.—A Monograph of the Carolina Paroquet, Edwin M. Hasbrouck. Notes on Bacteria of Cucurbits, Byron D. Halsted. On Coloration in Certain Reptilia, E. D. Cope. Transpiration or the Loss of Water in Plants, Chas. E. Bessey and Albert F. Woods. Movements of Fluids in Plants, Wm. J. Beal. Absorption of Fluids by Plants, L. H. Pammel. Gases in Plants, J. C. Arthur. Notes Upon an Anthracnose, Byron D. Halsted. Origin and Development of Parasitic Habit in Mallophaga and Pediculidæ, Herbert Osborn. The Origin and Development of Parasitism Among the Sarcoptidæ, H. Garman. On the Habits of the Proctotrypidæ, Wm. H. Ashmead. The Biology of the Chalcididæ, L. O. Howard.

Section H.—An Experiment in Human Stirpiculture, Anita Newcomb McGee. Relics of Ancient Mexican Civilization, Zelia Nuttall. Bow Stretchers, Edward S. Morse. Prehistoric Bows, Edward S. Morse. The Nez Perce Country, Alice C. Fletcher. Relation of a Loveland, Ohio, Implement-Bearing Terrace to the Moraines of the Ice Sheet, Frank Leverett. Utility of Psychical Study of Child Life, Laura Osborne Talbott. Origin of the Name Chautauqua, Albert Gatschet.

SATURDAY, 22D.—*Section E.*—The Attitude of the Eastern and Central Portions of the United States During the Glacial Period, T. C. Chamberlin. Neocene and Pleistocene Continent Movements, W. J. McGee. Results of a Well-Boring at Rochester, N. Y., Herman L. Fairchild. On a Deep Bore near Akron, Ohio, E. W. Claypole. The Relations of the Archean and the Algonkian in the Northwest, C. R. Van Hise. A Study of the Fossil Avifauna of the Silver Lake Region, Oregon, R. W. Shufeldt. The Peninsula and Volcano Cosignina, J. Crawford. The Geological Survey of Nicaragua, J. Crawford. The Highest Old Shore Line on Mackinac Island, F. B. Taylor. Striæ and Slickensides at Alton, Illinois, J. E. Todd.

Section F.—Parasitism in Coleoptera, in Diptera, in Braconidæ, and Ichneumonidæ, C. V. Riley. Microorganisms as Insecticides, C. V. Riley. Enemies of the Honey Bee, A. J. Cook. Notes on the Homology of the Hemipterous Mouth, John B. Smith. Epipharynx

and Hypopharynx of Odonata, John B. Smith. The Mouth of the *Copris carolina*, and Notes on the Homology of the Mandible, John B. Smith. On the Phylogeny of the Archegoniata, Douglas H. Campbell. On the Turtles of the Genus *Malaclemys*, O. P. Hay. The President Condition of the Study of the Deep-Sea Fishes, G. Brown Goode. On the Injection of Blood from the Eyes of Horned Toads, O. P. Hay. Abnormal Bees, A. J. Cook. On the Importance of a Table at the Naples Station, Chas. W. Stiles. Further Observations on a Bacterial Disease of Oats, B. T. Galloway. Botanical Field-Work of the Botanical Division, George Vasey. Results from Recent Investigations of Pear Blight, M. B. Waite. The Spectroscope in Botanical Studies, I. S. Brashear. The Persistence and Relation of Faunal Realms, Theodore Gill. The New Zealand Fish Fauna, Theodore Gill. A Case of the Loss of Sense of Smell, Joseph Jastrow. A Novel Color Illusion and a New Method of Color Mixture, Joseph Jastrow. Modification of Habit in Paper-Making Wasps, Mary E. Murtfeldt. The Fate of the Fur Seal in American Waters (lantern illustrations), Wm. Palmer.

Section H.—An Ancient Human Cranium from Southern Mexico, F. W. Putnam. The Length of a Generation, C. M. Woodward. Burial Customs of the Hurons, Chas. A. Hirschfelder. The Messiah Religion and the Ghost Dance, James Mooney. Study of a Dwarf, Frank Baker. Stone Drills and Perforations in Stone from the Susquehanna River, Atreus Wanner. Evidences of the High Antiquity of Man in America, Thos. Wilson. On Bone, Copper, and Slate Implements Found in Vermont, G. H. Perkins. Some Archeological Contraventions, Gerard Fowke. On the Distribution of Stone Implements in the Tide-Water Province, W. H. Holmes. Aboriginal Novaculite Quarries in Arkansas, W. H. Holmes. Games of Teton Dakota Children, James Owen Dorsey. Geographical Arrangement of Prehistoric Objects in the U. S. National Museum, Thos. Wilson. Curious Forms of Chipped Stone Implements Found in Italy, Honduras, and the United States, Thos. Wilson. Inventions of Antiquity, Thos. Wilson. Study of Automatic Motion, Joseph Jastrow. Race Survivals and Race Mixture in Great Britain, W. H. Babcock.

Excursions.—On Saturday, Sunday, Monday, and Tuesday the following excursions were proposed for the association: To Luray, Va. (expense, \$7.50); to Atlantic City; Norfolk, and Virginia Beach, Va. (expense, \$8.00); Baltimore (\$2.00); Mount Vernon, Va. On account of the expense, some of these excursions were not or but little patronized. This was a unique feature in the history of the American Association.

On the evening of Friday the 21st, Prof. John M. Macfarlane, of Edinburg, delivered an address consisting of "Illustrations of Heredity in Plant Hybrids," which was illustrated by enlarged views of plant cell structures thrown on a screen.

At the conclusion of the lecture the council met and elected the following officers for 1892:

President, Prof. Joseph LeConte, of the University at Berkeley, Cal.; permanent secretary, Prof. F. W. Putnam, Cambridge, Mass.; general secretary, Prof. Amos W. Butler, Brookville, Ind.; council secretary, Prof. T. H. Horton, of Cincinnati University; and treasurer, William Lilly, Mauch Chunk, Pa. The vice presidents of sections number: A, Prof. J. R. Eastman, of the Naval Observatory, Washington; B, Prof. B. F. Thomas, State University, Columbus, Ohio; C, Dr. Alfred Springer, Cincinnati; D, Prof. J. B. Johnson, Washington University, St. Louis; E, Prof. H. S. Williams, Cornell University; F, Prof. S. H. Gage, Cornell University; H, W. H. Holmes, of the Ethnological Bureau; and I, Prof. S. Dana Horton, Pomeroy, Ohio.

Dr. H. Wheatland, of Salem, Mass., and Mr. Thomas Meehan were chosen auditors, and the following gentlemen will be the new secretaries of sections:

A, Prof. Winslow Upton, Brown University, Providence, R. I.; B, Prof. Browne Ayers, Tulane University, New Orleans; C, Prof. J. L. Howe, Louisville Polytechnic Institute; D, Prof. O. H. Landreth, Vanderbilt University; E, Prof. R. D. Salisbury, University of Wisconsin; F, Prof. B. D. Halsted, Rutgers College, New Brunswick, N. J.; H, Dr. Stewart Culin, Philadelphia; and I, Lester F. Ward, of the Geological Survey, Washington.

The council was in receipt of a hearty invitation to select Rochester, N. Y., as the place of the next convention, and a ballot resulted in the choice being made.

A general session was held on the evening of Tuesday, August 25th, when the above officers and place of meeting were chosen for 1892. An invitation to meet in Chicago during the exposition in 1893 was presented by a Mr. Young in a speech commensurate with the anticipated grandeur of the event. Resolutions of thanks to the various entertaining bodies and authorities were adopted.

The Geological Society of America.—This organization commenced its session August 24th in the Columbian University building, Washington, D. C., and closed it on the evening of August 25th.

Owing to the death of the president, Prof. Alex. Winchell, the vice president, Mr. G. K. Gilbert, took the chair.

In opening the meeting the acting president, Mr. G. K. Gilbert, made a few brief remarks, in which he welcomed the society to Washington, and, in the name of President Welling, to the university. A touching memorial of the deceased president of the society, Alexander Winchell, was read by Prof. N. T. Winchell, brother of the deceased. The paper gave a sketch of the life and work of Prof. Winchell, and was a fitting tribute to a man who occupied his high position among geologists.

The following papers were read :

MONDAY, AUGUST 24TH.—A Geological Map of South America, Prof. Dr. Gustav Steinmann, University of Freiburg, Germany. On the Permian, Triassic, and Jurassic Formations in the East Indian Archipelago (Timor and Rotti), Dr. August Rothpletz, University of Munich, Germany. Thermometamorphism in Igneous Rocks, Mr. Alfred Harker, St. John's College, Cambridge, England. The Lower Silurian (Ordovician) Ichthyic Fauna, and Its Mode of Occurrence, C. D. Walcott. Relations of the Plant-Bearing Deposits of the American Trias, Lester F. Ward. Studies in Problematic Organisms: The Genus *Scolithus*, Joseph F. James. The Tertiary Iron Ores of Arkansas and Texas, R. A. F. Penrose, Jr. Contribution to the Geology of the Plains, Sandstone Dikes in Northwestern Nebraska, Robert Hay. Some Recent Experimental Reproductions of Scottish Mountain Structures, Henry M. Cadell, Esq., Scotland. Mechanics of Appalachian Structure (with lantern illustrations), Bailey Willis.

TUESDAY, AUGUST 25TH.—The Relations of the Fossil Echinoid Faunas of Europe and America, Mr. John Walter Gregory, British Museum, London, England. On the Eurypteris Beds of Oesel as Compared with Those of the Waterlime of North America, Dr. Friedrich Schmidt, Academy of Sciences, St. Petersburg, Russia. Sur les Couches Marines Terminant le Jurassique et Commencant le Crétacé et sur l'Histoire de leur Faune, Prof. Alexis Pavlow, University of Moscow, Russia. Sur l'Homme Contemporain du Mammouth en Belgique, Prof. Max Lohest, University of Liège, Belgium. On the Quaternary Changes of Level in Scandinavia, Baron Gerald de Geer, State Geologist, Stockholm, Sweden. The Black Earth of the Steppes of Southern Russia: Its Origin, Distribution, and Points of Resemblance With the Soils of the American Prairies, Prof. A. Krasnof. Sur l'Existence du Dinotherium en Roumaine, Prof. Gregoire Stefanescu, University of Bucharest, Roumania. The Present Standing of

the Several Hypotheses of the Cause of the Glacial Period, Thomas C. Chamberlin. On the Northward and Eastward Extension of Prepleistocene Gravels in the Basin of the Mississippi; On Certain Extra Morainic Drift Phenomena of New Jersey, R. D. Salisbury. Inequality of Distribution of the Englacal Drift, Warren Upham. Defloration and Deformation of Alluvial Deposits in New England, Homer T. Fuller. The Elæolite Syenite of Beemerville, N. Y., J. F. Kemp. On the Separation and Study of the Heavy Accessories of Rocks, Orville A. Derby. Contributions to the Areal Geology of the Texas-New Mexico Region: (a) The Tertiary History of the Rio Grandê Embayment; (b) The Llano Estacado and Edwards Plateau; (c) The Basin Formations of New Mexico, and Accompanying Volcanic Craters; (d) The Las Vegas Raton Plateau, R. T. Hill. The Missouri Coal Measures and the Conditions of their Deposition, Arthur Winslow. The Well's Creek Basin and Uplift in Stewart and Houston Counties, Tennessee; The Pelvis of the Megalonyx, and the Lot of Undescribed Bones Among which It is Found, from Big Bone Cave, in Tennessee, James M. Safford. The Cienegas of Southern California; A Description and Discussion of Their Geological Structure and Origin, E. W. Hilgard. Notes on the Crystalline Rocks of Central Texas, with Maps, T. B. Comstock. On a Deep Boring near Akron, Ohio, and Its Significance, E. W. Claypole. The Natural Bridges of Florida and the Chattahoochee Embayment, Lawrence G. Johnson. On Some Peculiar Causes which are Influencing Topographical Changes and Geological Formations in the Channel Islands of California, Lorenzo G. Yates.

The International Geological Congress.—This body met in the Columbian University, Washington, D. C., from August 26th to September 2d, inclusive. The officers of the meeting were: Honorary presidents, J. D. Dana, James Hall. President, J. S. Newberry. Vice presidents—United States, Joseph Le Conte, J. W. Powell, and Raphael Pumpelly; Canada, J. C. K. Laflamme and W. Macfarlan; Mexico, A. del Castillo; England, T. McK. Hughes; Scotland, H. M. Cadell; France, A. Gaudry and Charles Barrois; Belgium, E. Van den Broeck; Holland, G. A. F. Molengraaff; Norway, H. Reusch; Sweden, Gerard de Geer; Russia, Th. Tschernychew, F. Schmidt, and A. Pavlow; Denmark, Dr. Johnstrup; Germany, Dr. Von Zittel and H. Credner; Austria, Dr. E. Tietze; Hungary, Joseph Von Szabo; Spain, M. F. de Castro; Portugal, Joaquin Filipe Nery Delgado; Italy, Prof. G. Uzielli; Switzerland, H. Gollier;

Roumania, G. Stefanescu ; India, F. R. Mallet ; New Zealand, F. Hutton ; Australia, Arch. Liversidge ; Chili, F. J. San Roman. General Secretaries, H. S. Williams, S. F. Emmons. Secretaries, J. C. Branner, Emm. de Margerie, G. H. Williams, Dr. F. Frech, Dr. Diener, Whitman Cross. Treasurer, Arnold Hague.

Owing to the illness of Prof. Newberry the chair was taken by Prof. T. McKenna Hughes, of England ; Prof. Karl Von Zittel, of Munich ; Prof. Albert Gaudry, of Paris ; and by Prof. Joseph LeConte, first vice president. Prof. Hughes made the opening address, and was succeeded by the Hon. Gardner C. Hubbard, of Washington, in an address of welcome from the city. On behalf of the president and the government Hon. J. S. Noble, Secretary of the Interior, delivered an address of welcome, which was followed by a few remarks from Major J. W. Powell.

The program of proceedings was as follows :

WEDNESDAY, AUGUST 26TH.—10 A.M., meeting of the council for nomination of bureau. 2 P.M., opening of the congress, election of bureau, addresses, etc. 9 P.M., reception at the Arlington Hotel by the Geological Society of America.

THURSDAY, AUGUST 27TH.—10 A.M., meeting of the council. 11 A.M., morning meeting of congress. 2.30 P.M., afternoon meeting of congress. Evening reception by Mr. and Mrs. S. F. Emmons, at 1725 H Street, 10 P.M., and by Mr. and Mrs. Thomas Wilson, 1218 Connecticut Avenue.

FRIDAY, AUGUST 28TH.—10 A.M., meeting of council. 11 A.M., morning session of congress. 2.30 P.M., afternoon session of congress. Evening, the National Museum was opened to members of the congress.

SATURDAY, AUGUST 29TH.—10 A.M., morning session of congress. Afternoon, no special program made.

MONDAY, AUGUST 31ST.—10 A.M., meeting of council. 11 A.M., morning session of congress. Evening, 9 to 11, reception by the director and members of the Geological Survey at 1330 F Street.

TUESDAY, SEPTEMBER 1ST.—10 A.M., meeting of council. 11 A.M., closing session of congress. Afternoon, excursion on the Potomac, on steamer furnished by the committee, and dinner at Marshall Hall.

It had been recommended by the managing committee that the discussion open on the following topic :

I. Time correlation of the clastic rocks.

1. Correlation by structural data.

- a.* By stratigraphical data.
- b.* By lithological data.
- c.* By physiographical data.

2. Correlation by paleontological data.

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| <ul style="list-style-type: none"> <i>a.</i> By fossil plants, <i>b.</i> By fossil animals, | or | <ul style="list-style-type: none"> <i>a.</i> By marine fossils. <i>b.</i> By terrestrial fossils. |
|---|----|---|

II. General geological color schemes and other graphic conventions.

III. Genetic classification of the Plistocene rocks.

The consideration of the first division of the above plan was taken up by the presentation of a synopsis of the subject by Prof. G. K. Gilbert. The third part of the subject was opened by the presentation of two systems of glacial phenomena, one by President Chamberlin and the other by Mr. W. T. McGee. The discussion was as follows:

Prof. Gaudry spoke as follows: In the Parisian basin there are two different horizons distinguished by different faunas, the one indicating a cold, the other a warm climate. It is, however, impossible to decide which of these two periods was the earlier. In England the same condition of affairs is to be observed. In Germany there is but one Quaternary fauna, which indicates a cold climate, whilst in Italy the fauna of the cold period is absent.

Prof. H. Credner: The North German plain contains deposits closely related to those of the Plistocene in America. Prof. Chamberlin's classification is admirable and wholly applicable to Germany.

Baron de Geer expressed his approbation of the classification proposed by Prof. Chamberlin. He had for some years been advocating a similar classification for Scandinavia. A few minor alterations might be suggested to suit Scandinavian conditions; for instance, the marine deposits might be made a separate class; classes IV. and V. of Prof. Chamberlin could, perhaps, be reduced to subclasses under III., as the formations frequently seem to be accidental or local. He agreed with the distinction suggested between osars and kames,—that is, that the former are in the main radial and the latter peripheral with reference to the distribution of land ice.

Prof. T. McK. Hughes pointed out that the classification given by Prof. Gaudry was purely chronological, whereas that suggested by Prof. Chamberlin was purely genetic. He then explained the abundance of striated boulders in one part of the glacial deposits and their absence in another. If the supply of material (that is, of rock bosses

above the ice) ceases at any point, then all the boulders will gradually sink through the ice and become glaciated at the bottom. Prof. Hughes also thought that two distinct types of ridges formed of glacial material were confused under the names kames, osars, and eskar. He also explained that "pitted plains" as due to an unusual interruption between the hills or ridges of eskar character. He expressed his opinion that the Glacial period was a continuous one, in England at least, except for slight changes due to unimportant oscillations.

Dr. Wahnschaffe advocated the chronological classification, and considered such a one possible for the Quaternary deposits of North Germany. These deposits begin with pre-Glacial sands and gravels containing *Paludina diluviana*, which is still a living form, and *Lithoglyphus naticoides*. Above these follows a typical ground moraine, which is overlaid by stratified sand and gravel, containing the well-known diluvial fauna; and to these again succeeds the upper till, considered now as the ground moraine of the second glacial epoch.

Prof. H. Credner: The occurrence of the sand between two ground moraines indicates a retreat and second advance of the ice sheet. Such interpolated sands are in Germany always local, and no proof of a real interglacial epoch. The sand layers between the moraines are not continuous, but local, and cannot be given the significance attributed to them by Wahnschaffe.

Prof. Pavlow: In order to secure a satisfactory classification of Quaternary deposits, we must secure a satisfactory definition of Pleistocene. Prof. Pavlow said he would like to give his own views, but would postpone them until such accepted definition had been arrived at.

Baron de Geer agreed with Wahnschaffe that the chronological classification is at least locally possible. He also recognized two glacial epochs, due to two great oscillations. These cannot always be separated, as, for instance, in Russia. For this reason it is best to commence with a genetic classification, since this causes less confusion to the field geologist.

Dr. Wahnschaffe replied to Prof. Credner's assertion that there is no proof of an interglacial period in Northern Germany. He that that the existence of a diluvial fauna between the two tills is sufficient proof.

Prof. Credner replied that no complete skeleton had been found, but only single bones which might have been transported and deposited with the gravel.

Dr. Wahnschaffe again replied that the bones occurring in these gravels are proportionately large, when compared with the gravels

themselves, and therefore cannot well have been transported from a distance.

Prof. Shaler : Organic deposits may possibly occur very near the ice sheet, which allows an interweaving of organic and glacial deposits.

Mr. G. K. Gilbert remarked on the observation of I. C. Russel in Alaska, that where the movement of the ice is very sluggish it may become covered with soil, or even with a growing forest, in which such animals as bears still live.

Dr. Diener remarked that intercalated beds of sand were no positive proof of interglacial periods. In the Austrian Alps moraines no more than twenty years old are covered with pasture, and in the Caucasus the rhododendron grows to the very edge of the ice.

Dr. Holst mentioned two moraines separated by interpolated sand, and thought that they might both have been formed by the same ice sheet. The melting of the ice leaves unoxidized (blue) ground moraine, with an overlaying oxidized (yellow) upper moraine. This also occurs in Northern Sweden, where there is no indication of a retreat of the ice.

Baron de Geer could not understand the occurrence of thirty or forty feet of stratified sand between two moraines of the same glacier. The colors are sometimes the reverse of what has been stated by Dr. Holst, and the boulders in the two moraines have been derived from different sources.

Mr. Christie described the section of peat and silt between two layers of till occurring on the river Clyde, above Glasgow.

Mr. Cadell described some five distinct layers of till occurring in a pre-Glacial river channel in Eastern Scotland; and also mentioned another river channel, filled with coarse gravel derived from rocks occurring farther north in Scotland, which was covered with a later layer of boulder clay.

Mr. McGee mentioned the importance of land forms in interpreting geological processes. Any primary geological classification must be genetic. He discussed in detail the following scheme of classification of Plistocene deposits:

Classification of Plistocene Formations and Land Forms.

A. Aqueous:

1. Below base level.
 - a. Marine.
 - b. Estuarine.
 - c. Lacustral.

2. At bass level.
 - a. Littoral.
 - b. Marsh.
 - c. Alluvial (certain terraces, etc.)
 3. Above base level.
 - a. Torrential.
 - b. Talus (including playas).
- B. Glacial :
1. Direct. (Chamberlin's class I.)
 2. Indirect. (Chamberlin's classes II. to V., in part.)
- C. Aqueo-Glacial : (Chamberlin's classes II. to V., in part.)
- D. Eolic : (Chamberlin's class (?) VI.)
1. Direct.
 - a. Lava sheets.
 - b. Cinder cones.
 - c. Tuffs, lapilli sheets, etc.
 2. Indirect.
 - a. Ash beds.
 - b. Lapilli sheets.

Prof. Chamberlin, in closing the discussion, said that there was great difficulty in applying a chronological classification, and that such a classification might even act as a barrier to observation and to the recognition of the truth. Chronological classification is the ultimate goal of glacial studies, but it is something for which we are not as yet prepared. Red, oxidized subsoils are not developed in northern latitudes. Organic deposits between glacial layers are abundant in the west, but do not belong to a single horizon. Many facts of erosion and physical geology indicate that the Glacial epoch in America was widely differentiated, and of long duration. How many distinct periods it embraced we do not as yet know.

Prof. Cope: An abundant tropical fauna is found in the "Equus beds," which, if they be of interglacial age, indicates at this time a warm climate. This fauna is succeeded by a truly boreal fauna. In this is contained material for a chronological subdivision of Pleistocene deposits.

Prof. Gaudry read the following remarks at the close of the congress :

Mr. President and Ladies and Gentlemen :

We regret that Prof. Joseph Prestwich, president of the fourth international geological congress, was not able to be present to install

the officers of the fifth congress, but we are pleased that he should have delegated in his place Prof. Hughes, who is so appreciated by all geologists. We regret also that Prof. Newberry is not in attendance to preside over our deliberations, as we had hoped. In the excellent work which he has recently published on the fossil fishes we were shown a sample of his vigor and his spirit, but unhappily his physical strength would not permit him to attend at our call, and preside over this congress. But to console us we have chosen another eminent geologist, Prof. Joseph LeConte. In the name of my brother geologists I have to thank him for the talent and kindness with which he has directed our session. It is now thirteen years since we organized at Paris the first international congress of geologists. My friends MM. Delaire and Barrois, who are here with us to-day, and who were secretaries of that first congress, can tell you that we were not then without inquietude for its success. Thanks to the Lord and thanks to you, it has developed into a complete success. We ought not to forget that if it was at Paris that the first congress was organized, it was in America that the project was started. Hence sprang the generous and fecund idea to unite the different members of the great family of geologists. I am but the interpreter of the sentiments of my brother members of the international congress of geologists, whether present or absent, in addressing the most cordial thanks to the American savants who were the inspiration of this congress. The congresses at Bologna, Berlin, and London had grand success, while this at Washington is not less satisfying. In truth, we have not made any new regulations, and the anterior congresses made many. There are regulations for nearly everything *en peu faut, pas n'en faut*. We should guard against personality, and ought always to respect the liberty of science. It is most important that we should elevate science in the greatest degree possible. Our domain is immense, since we make the history of all the earth. We should give to our spirits an amplitude equal to that of the vast domain which we are charged to explore. By the natural force of things each one of us is drawn to study special branches; in order to make original work, one must concentrate his power upon a single branch of science. Some of us are pleased to make our researches among the vertebrates,—strange and gigantic animals which peopled our continents in past times. Others attach themselves to the study of invertebrates,—creatures humbler, but which render great service to geology in the determination of the ages of the earth. Still others consider the flora, and make corresponding classifications. Some prefer the primitive *terrains* which reveal to us the

origin of life, while still others prefer the secondary and Tertiary *terrains*, which show the world in a more advanced state, and so continue the mystery of the origin of humanity. Many of our brethren occupy themselves with physical or chemical geology. We have reason to hope much from this division of labor. It is necessary that at certain periods we should collect all the products of our activity, that we should show to the world wherever interested, and to our brother geologists, the various processes by which we have arrived at our conclusions. Each one of us is but a minimum, but the entirety of our knowledge will form a marvelous structure, and one of great strength. Such is the work of our international congress.

Gentlemen, we have the good fortune to be co-workers, and as such we should love and be loved by one another. I believe I am the oldest of all the geologists who have crossed the Atlantic Ocean to attend this congress. I have met many ardent workers in my life, and I declare to you in all the sincerity of my soul that the more I see and the better I know the men of science the more and better I love them. It is a long time since we learned to admire the American geologists, but we come now to learn to love them. In returning to our homes in the Old World we will carry with us a cherished souvenir of the members of the international congress of geology at Washington.

The following names were recorded as the Founders' Committee: James Hall, T. Sterry Hunt, J. W. Dawson, J. S. Newberry, C. H. Hitchcock, R. Pumpelly, J. P. Lesley, T. H. Huxley, O. Torell, E. H. de Baumhauer.

The following members of the congress were present from foreign countries: *Austria-Hungary*—Dr. Karl Diener, a. d. k. k. Universität, Wien; Dr. Emil Tietze, Chefgeolog des K. K. geol. Reichsanstalts, Wien. *Belgium*—Prof. Max. Lohest, à l'Université, Liège; Dr. Xavier Stainier, Com. géol. de Belgique, Bruxelles; Mr. E. Van Broeck, Commission géologique de Belgique, Bruxelles; *Canada*—Frank D. Adams, McGill College, Montreal; Thomas MacFarlane, Inland Revenue Dept., Ottawa. *France*—Prof. Dr. Charles Barrois, à l'Université, Lille; Mr. Marcellin Boule, du Muséum d'hist. nat., Paris; Prof. Albert Gaudry, du Muséum d'hist. nat., Paris; Mr. Emm. de Margerie, Service de la carte géol. de la France, Paris. *Germany*—Prof. Dr. Achilles Andreae, an der Universität, Heidelberg; Prof. Dr. E. W. Benecke, an der Universität, Strassburg; Dr. Alfred Bergeat, München; Dr. Georg von dem Borne, Halle; Prof. Dr. Her-

mann Credner, an der Universität, Leipzig. Prof. Rudolf Credner, an der Universität, Greifswald; Dr. F. Frech, an der Universität, Halle; Dr. Otto Jaekel, an der Universität, Berlin; Prof. Dr. Emanuel Kayser, an der Universität, Marburg; Dr. W. Koenigs, an der Universität, München; Dr. Carl Ochsenius, an der Universität, Marburg; Dr. Alfred Osann, an der Universität, Heidelberg; Herr Felix Plieninger, München; Herr Julius Romberg, Berlin; Dr. August Rothpletz, an der Universität, München; Herr Ulrich Söhle, München; Prof. Dr. G. Steinmann, an der Universität, Freiburg; Dr. Arnold, Ulrich, an der Universität, Strassburg; Herr Adolf Viedenz, Bergrath, Eberswalde-Berlin; Dr. Felix Wahnschaffe, an der Universität, Berlin; Dr. Bruno Weigand, Strassburg; Dr. Baron Sidney von Wöhrmann, München; Dr. E. A. Wülfig, an der Universität, Tübingen; Prof. Dr. von Zittel, an der Universität, München. *Great Britain*—John W. Gregory, Esq., F.G.S., British Museum, London; Alfred Harker, Esq., F.G.S., St. John's College, Cambridge, Eng.; Prof. T. McKenny Hughes, Esq., F.R.S., F.G.S., Cambridge University, Cambridge, Eng.; Mrs. Mary C. Hughes, Cambridge, Eng.; Hugh Leonard, Esq., late Chief Engineer Indian Pub. Works Dep't, London; Lieut.-Col. A. O. Tabuteau, F.G.S., Bath, Eng. *Mexico*—Antonio del Castillo, Dir. de l'École des Ingénieurs, City of Mexico. *Norway*—Dr. Hans Reusch, Director of the Geological Survey of Norway, Christiana. *Roumania*—Prof. Stefan Sihleana, à l'Université, Bucharest; Mdme. Henriette Sihleano, Bucharest; Prof. Grégoire Stefanescu, à l'Université, Bucharest; Mdme. Maria G. Stefanescu, Bucharest. *Russia*—Prof. A. N. Krassnof, à l'Université, Charkow; Prof. Alexis Pavlow, à l'Université, Moscow; Mdme. Marie Pavlow, Moscow; Prof. F. Schmidt, Comité géologique de la Russie, St. Petersburg; Prof. P. Tschernyschew, Comité géologique de la Russie, St. Petersburg. *Sweden*—Gerard de Geer, Geological Survey of Sweden, Stockholm; Nils Olaf Holst, Geological Survey of Sweden, Stockholm; Hjalmar Lundbohm, Geological Survey of Sweden, Stockholm; Prof. Hjalmar Sjögren, at the University, Upsala. *Switzerland*—Prof. H. Gollier, à l'Université, Lausanne; Prof. Dr. C. Schmidt, à l'Université, Bâle.

An excursion to the Rocky Mountains under the guidance of the U. S. Geological Survey followed the adjournment of the congress. On reaching Salt Lake the party divided, one part visiting the Grand Canyon of the Colorado, the other the Yellowstone Park. A remarkable peculiarity of this excursion was the fact that it was made at the expense of the visitors, the hosts charging each of them \$265.

